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The Journal
OF THE
Ministry of Agriculture

SEPTEMBER, 1922.

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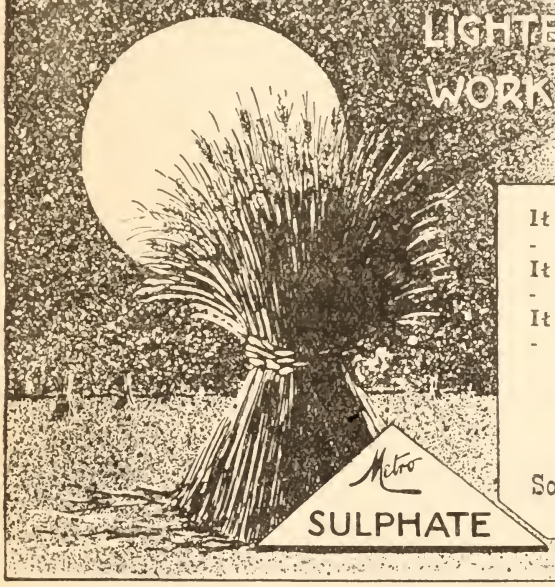

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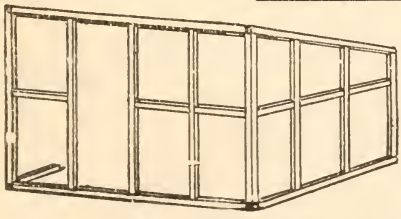

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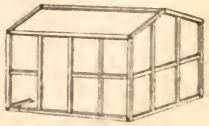

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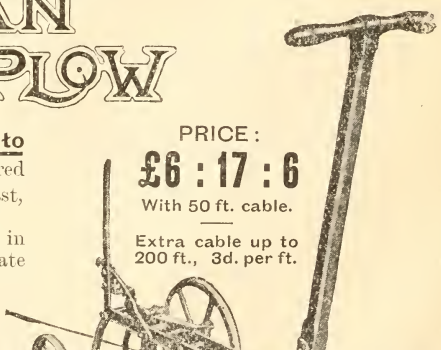

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Agricultural Statistics of England and Wales.

The Agricultural Statistics for 1921 are issued in three parts, as follows, and give, in addition to particulars for England and Wales, summaries for Great Britain and Ireland.

Agricultural Statistics, 1921, Part I.—Report on the Acreage under Crops and Number of Live Stock. *Price* 2*s.*

Agricultural Statistics, 1921, Part II.—Report on the produce of Crops. *Price* 1*s.*

Agricultural Statistics, 1921, Part III.—Report on Prices and Supplies. Prices of Corn, Live Stock and other Agricultural Produce. Imports of Agricultural Produce. Corn Crops and Number of Live Stock in the Colonies and Foreign Countries. *Price* 1*s.* 6*d.*

The three parts, taken together, contain information on the main points of economic interest affecting agriculture. Each part is prefaced by a Report dealing with the principal features of the year's figures.

Order through a bookseller or from H.M. Stationery Office, Kingsway, London, W.C. 2, or 28, Abingdon Street, S.W. 1.

Report of the Intelligence Department, Ministry of Agriculture and Fisheries, 1919—1921.

A Report of the Intelligence Department of the Ministry, covering the two years ending 31st March, 1921, has just been issued, and contains an account of the work accomplished during that period in connection with the following:—

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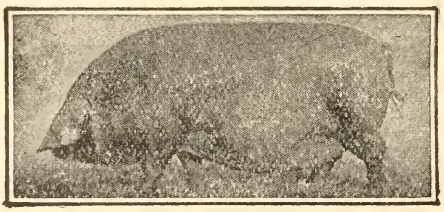

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THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE

Vol. XXIX. No. 6.

SEPTEMBER, 1922.

NOTES FOR THE MONTH.

The Ministry's Journal.

Nearly thirty years ago, when Lord Burghclere was President of the Board of Agriculture and Sir Thomas Elliott Permanent Secretary, it was increasingly felt that the Department required some means of reaching agriculturists in order to bring before them Acts of Parliament and the Orders and Regulations of the Board as well as much information of interest and importance which the Board received through official channels, but which it had at that time no means of bringing to the notice of the public. It was decided that the most suitable means would be the publication of an official quarterly Journal and this was finally sanctioned. The first issue was published in September, 1894, and the introductory notice in the first number stated that it was proposed to give publicity through the medium of the Journal to information of interest to agriculturists and that it should record "statistical and other intelligence which could not be reasonably or conveniently inserted in the annual publications of the Department." The condition of agriculture within the Empire and in foreign countries, the results of research at home and abroad, innovations in systems of cultivation, improvements in marketing and distributing produce, farm pests, agricultural statistics, diseases of animals—all these and other matters were to be dealt with.

It was soon felt that a quarterly Journal was unsuitable, as much information which it was desired to issue could not be delayed, and after April, 1897, monthly publication was adopted. Since that date many changes have taken place in the *Journal* in harmony with the extension in the duties and interests of the Department; agricultural education and research have gone forward with a bound, and the influence of progress in this direction is nowhere more noticeable than in the pages of the *Journal;* plant diseases and insect pests were always a prominent feature, though the early issues gave but scant attention either to horticulture or poultry, two branches of agriculture which now obtain a fair share of the limited number of pages available. But perhaps the greatest change which would be noticed if a recent

(44721). P.1./R.3. 10,750. 9/22. M. & S.

issue of the *Journal* were compared with some of the early numbers lies in the development of what may be called the practical scientific side; articles by recognised authorities dealing with practical matters are now a pronounced feature of its pages, and it is on these articles, no less than on the notes and articles relating to administrative action. that its success and its real value to the agricultural community depend. During recent years the circulation has doubled and now exceeds 10,000 monthly.

* * * * * *

Milk and Dairies (Amendment) Act, 1922.

The Milk and Dairies (Amendment) Act, which was passed on 1st August, postpones for a further three years the operation of the Milk and Dairies (Consolidation) Act, 1915, and makes further provision with regard to the sale of milk. Except where otherwise expressly provided, the Act comes into operation on 1st September, 1922.

The Act provides that a Local Authority may, after allowing a hearing, refuse to register or may remove from the register any milk retailer if they are satisfied that the public health is or is likely to be endangered by any act or default of his in relation to the quality, storage or distribution of milk. The retailer has the right of appeal to a Court of summary jurisdiction. A further appeal may then be made by either the Local Authority or the retailer to the next Court of Quarter Sessions, whose ruling is final.

As from 1st January, 1923, milk described as "certified," "Grade A" and "pasteurised" may be sold only under a special licence granted by the Ministry of Health, or under its authority.

The addition of other substances to milk and the sale of reconstituted milk as milk are prohibited.

The sale of milk from a cow suffering from tuberculosis of the udder is prohibited. and if it is proved that the seller knew of, or could with ordinary care have ascertained, the existence of the disease. he is liable to a fine not exceeding £20 for the first offence, and a fine not exceeding £100. or imprisonment, or both, for subsequent offences.

Except as otherwise provided. offences against the Act may render a milk retailer liable to fines of £5 for the first offence, £50 for subsequent offences and a further 40s. per day if the offence is a continuing one. The retailer may also be removed from the register. either absolutely or in respect of any specified premises for a period. At the discretion of the Local Authority,

proceedings may be taken against a servant or agent if they are satisfied that blame does not attach to the employer.

The Act also empowers the Ministry of Health to make regulations as to milk imported for public consumption and as to the labelling and marking of dried, condensed, skimmed or separated milk.

All orders made by the Ministry of Health under this Act* will be laid before Parliament, and orders made after the commencement of this Act under the Contagious Diseases (Animals) Acts will be made with the concurrence of the Ministry of Agriculture and Fisheries.

* * * * * *

Forecast of the Production of Corn Crops.

A FORECAST of the production of the principal cereal crops was issued by the Ministry early in August. Hitherto these estimates have only been issued at the end of October, when results obtained from threshing afford a more certain guide to the produce of the harvest. Practically all the leading countries in the world, however, make estimates in advance of their harvests, and the Ministry decided this year to adopt a similar practice. It will be understood that this forecast, which was made on the 1st August, is necessarily subject to modification owing to weather and other conditions, and this will be particularly the case this year, when bad weather was experienced immediately after the forecast was made. The figures as estimated on the 1st August for England and Wales were as follows :—

	Area (*Acres*).		*Production* (*Qr.*).	
	1921	1922	1921	1922
Wheat	1,976,000	1,969,000	8,722,000	7,880,000
Barley	1,436,000	1,362,000	5,309,000	5,090,000
Oats	2,149,000	2,161,000	10,033,000	9,290,000
Beans	237,200	272,000	778,000	920,000
Peas	105,700	123,000	313,000	340,000

The annual preliminary statement of the area under crops and grass and the number of live stock in England and Wales was also issued early in August, and is reproduced on p. 572 of this *Journal*.

* * * * * *

Summer Time.

SUMMER time this year has been fixed by an Order in Council and will end at 2 o'clock on the morning of Sunday, 8th October.

For the future, however, the dates of beginning and ending have been laid down by the Summer Time Act, 1922, which was passed on 20th July last. Under

* Copies of the Act can be purchased through any bookseller or direct from H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2., price 3d. net.

this Act summer time will start at 2 o'clock in the morning of the day next following the third Saturday in April, or if that day is Easter Sunday, the day next following the second Saturday in April. It will end at 2 o'clock in the morning of the day next following the third Saturday in September.

In 1923, accordingly, summer time will start on Sunday, 22nd April, and end on Sunday, 15th September.

The Act applies only to the year 1923 and will therefore be brought up in Parliament for reconsideration annually under the "Expiring Laws Continuance Bill."

* * * * * *

Farmers' Income Tax.

IN his Budget Statement made on 1st May in the House of Commons, the Chancellor of the Exchequer proposed an important alteration in the assessment of farmers' profits for Income Tax under Schedule B, and by the Finance Act, 1922, these proposals have now become law. Under the Act the profits for the year 1922-23 will be reckoned as equal to the rent or annual value of the land, instead of twice the value, and the position will thus revert to what it was prior to the financial year 1918-19. One effect of this will be that many farmers whose assessed income, under the assessment that has been operative for the last four years, was sufficient to make them liable to Income Tax, will be exempt this year.

Furthermore, if a farmer can prove at the end of the year that he has not made a profit equal to the annual value of his land he can claim to pay on the actual profit, or alternatively he can elect to be assessed under Schedule D, that is, on the average of his actual profits for the three previous years. In both these cases, however, the production of accounts will be necessary in order to show what the actual profits were.

* * * * * *

Weather Forecasts by Wireless Telephone and Telegraph.

IN answer to a question in the House of Commons on 6th July, the Secretary of State for Air stated that the distribution of weather forecasts by wireless telephone would involve a capital expenditure of £5,000 and an annual upkeep of about £1,500. The provision of such a service would, he said, be considered when funds were available.

With regard to the sending out of forecasts by wireless telegraphy the Air Ministry has recently issued a pamphlet*

* *The Wireless Weather Manual*, M.O. 255, published by H.M. Stationery Office, price 9d.

containing particulars of the weather forecasts which are broadcast daily by wireless by the Ministry. The most valuable of these for agriculturists are: (1) a general forecast for the whole country, issued in plain language at 9.50 a.m. and 9.50 p.m.; and (2) forecasts for each of seven areas of Great Britain separately, issued in code three times daily. A key to the code used is given in the pamphlet.

Farmers would find both these valuable, especially at harvest time. The latter, which can be received and decoded in a quarter of an hour, is a forecast for the particular area drawn up a few minutes earlier by a professional forecaster with full information at his disposal.

The apparatus required for receiving the messages is described. A set complete costs about £30, but a user with knowledge of wireless apparatus can construct one from parts at a much lower cost. There are probably, however, in most neighbourhoods amateur wireless operators, some of whom would be glad to "listen in" for the information at the proper times, decode the messages and make them known locally by arrangement.

* * * * * *

Conciliation Committees in Agriculture.

Further wages agreements have been made by Conciliation Committees during the past month, and the total number in operation has now increased to 49.

In Kent, where negotiations were somewhat protracted, the Committee has recently reached the following agreement:— (1) Basic rate of wages for ordinary farm workers of 30s. for 50 hours guaranteed; (2) the recognised working week shall consist of 54 hours: overtime (*i.e.*, after 54 hours) worked at the request of the employer and Sunday labour at 8d. per hour. The agreement operates until the 7th October.

The Committee for the Holland Division of Lincolnshire has extended its previous agreement until the 31st October. The terms of the agreement provide for the payment of 8d. per hour for all hours worked by adult male workers. The settlement of the Rutland Committee makes provision for the payment of 30s. for a week of 50 hours up to the 28th October, to all male workers over 21 years.

In North Berkshire, where previous negotiations between the two sides had failed to solve the wages difficulty an agreement has now been reached to extend up to the 30th September. The terms mutually agreed upon are for the payment of

a rate of 30s. for a week of 50 hours, with 8d. per hour for all overtime.

In addition, the following harvest agreements have been made by the Norfolk and Suffolk Committees:—

Norfolk: During harvest, 1922:—A lump sum of £10 to be paid: the system of working by the harvest or by the month to be as hitherto, or by mutual agreement between employer and workers. Where the harvest is worked by the month it is to be understood that the same applies to 24 consecutive working days—hours not to exceed 70 per week.

Boys to receive proportionate rates.

Suffolk: During harvest, 1922:—(*a*) A weekly wage of 7¼d. per hour up to 50 hours; (*b*) a bonus of £4 10s. in addition on completion of harvest; (*c*) the agreement to cover a harvest of 24 days comprising 11 hours per day during cutting and 12 hours per day during carting: (*d*) if the nature of the crops makes it necessary to arrange special terms, provided such terms are mutually agreed, such agreement will not be prejudiced by this agreement.

Particulars of the agreements in any area can be obtained on application to the Ministry.

* * * * * *

The Agricultural Index Number.

THE index numbers of prices of agricultural produce in England and Wales indicate that, as compared with the average of the corresponding month of the years 1911 to 1913, prices in July were generally higher than in June. The average increase as compared with the pre-war years was 72 per cent. in July against an increase of 68 per cent. in June. The following table shows the general increases since the beginning of 1921:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES IN THE CORRESPONDING MONTHS OF 1911-13.

Month	1921	1922
January	183	75
February	167	79
March	150	77
April	149	70
May	119	71
June	112	68
July	112	72
August	131	
September	116	
October	86	
November	79	
December	76	

Fat cattle were very slightly cheaper in July than in June, and fat sheep continued the fall recorded in the previous month's figures. A seasonal fall in sheep prices normally occurs in the late spring and early summer, and the decline indicated by the index numbers does not fully reflect the decrease in prices which

has taken place since April. Fat pigs recovered the fall registered in June.

Cereals were also slightly cheaper in July than in June, as compared with the corresponding months in pre-war years, although in the case of oats the actual average price of 33s. 1d. per quarter in July shows an advance of 2d. on the month. Decreases were also recorded for poultry and for cheese, the latter being due as much to the marketing of new cheese as to any weakening in market values.

All other commodities showed a rise, this being especially marked in the case of milk and butter. Milk showed an advance of almost 2d. per gallon on the month, the average producers' price in July being 11½d. per gallon, while butter advanced by about 3¼d. per lb. The index number for eggs shows a rise of 11 points, in spite of the increase in the average pre-war price with which current prices are compared, and it seems that one of the effects remaining from the high prices of the past few years is the relatively greater violence of seasonal fluctuations in prices.

Although early potatoes were naturally dearer during July than old main crop potatoes had been during June, the July prices of early varieties were relatively cheaper as compared with the pre-war years, than old potatoes had been at the end of their season.

The following table shows the average increases in value of the principal commodities in the past seven months :—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	Jan.	Feb.	Mar.	April.	May.	June.	July.
Wheat ...	44	50	66	57	62	60	53
Barley ...	51	49	46	49	49	58	49
Oats... ...	49	48	53	49	53	57	55
Fat cattle ...	62	67	66	65	70	71	70
Fat sheep ...	60	72	100	128	140	121	107
Fat pigs ..	71	82	85	90	91	82	91
Eggs ...	114	166	95	89	50	69	80
Poultry ...	76	80	77	83	110	116	103
Milk... ...	125	117	92	42	27	28	53
Butter ...	46	41	37	49	54	59	79
Cheese ...	27	33	42	46	48	55	50
Potatoes ...	113	122	112	95	140	80	75
Hay... ...	35	32	32	28	33	35	37

Feeding stuffs showed a general advance in value in July compared with the preceding month, but in fertilisers there was a slight reduction. It is estimated that the average prices of both groups, feeding stuffs and fertilisers, are now between 40 and 50 per cent. above pre-war level.

* * * * * *

LAND DRAINAGE WORKS FOR THE RELIEF OF UNEMPLOYMENT.

C. H. J. CLAYTON, M.Inst.C.E.,
Ministry of Agriculture and Fisheries.

IN view of the exceptional amount of unemployment which existed in the autumn of 1921 a substantial sum was voted by Parliament for additional relief works. At the request of the Ministry a portion of that sum was allocated to drainage works for the purpose of alleviating unemployment among agricultural and other workmen in rural areas which were, in many cases, not provided for under previous schemes.

On 14th and 21st October last, the Ministry issued circulars addressed to Drainage Authorities and County Councils respectively inviting them to submit schemes and estimates for the improvement of drainage conditions within their areas of jurisdiction, for the alleviation of unemployment. The principal conditions laid down were that the work was to be carried out as far as possible by hand labour so as to absorb the maximum number of men; that 75 per cent. of the labour should be recruited from ex-Service men, the balance to be married civilians if available; that the work should be subject to the inspection and general supervision of the Ministry's technical staff; and that proper accounts should be kept.

The whole cost of approved schemes was to be advanced by the Ministry to the Drainage Authorities or County Councils who were respectively to repay to the Ministry within stated periods 25 per cent. and 33⅓ per cent., the latter under guarantee by the owners concerned. In a few exceptional cases repayments up to 50 per cent. of the sums advanced were arranged.

It was recognised at the outset that the winter season was not the most favourable for work in the larger channels, and suggestions were offered as to the possibility of useful work being done in small tributary rivers, brooks, main and tributary drains and field ditches.

Later, the County Councils were invited to submit schemes for water-supply to farms or groups of farms under similar conditions as to labour, but instead of advancing the whole cost of each scheme and recovering a percentage, the Ministry made a free grant in each case not exceeding the cost of unskilled unemployed labour on the scheme, or half the cost of the scheme, whichever was the less.

There were 362 drainage (including sea-defence) schemes, and 48 water-supply schemes submitted and approved, making a total estimated expenditure of nearly £400,000. Of these, 325 drainage or sea-defence schemes and 46 water-supply schemes were actually carried out, providing employment for about 150,000 men-weeks. The wage estimate in each case was based upon the current agricultural rate prevailing in the district, and in drainage and sea-defence schemes the expenditure on tools and materials was restricted to about 20 per cent. of the wage estimate. A small addition for local supervision was also allowed. Of the actual total expenditure, however, approximately 92 per cent. went in the wages of men previously unemployed.

Divisional Areas.—For purposes of inspection and supervision, the country was divided into 6 areas as under :—

Area No.	*Catchment Basins.*
1.	The Ouse, including the counties of Norfolk, Suffolk, Cambridge, Huntingdon and Bedford.
2.	The Weaver, Severn and Somersetshire rivers, and lands to the west thereof, including the whole of Wales.
3.	The Alt, Mersey and Yorkshire Ouse, and all lands to the north of their valleys.
4.	The Lower Trent, Derwent, Witham, Welland, Nene, Yare, Bure and Waveney.
5.	Lower Thames, Medway and the rivers of Suffolk, Essex, Kent and Sussex.
6.	Upper Trent, Upper Thames and such areas in the counties of Warwick, Gloucester, Wilts and Dorset as were not otherwise included.

Work was begun in November and continued with comparatively little interruption from bad weather or other causes till towards the end of March, which had been set as the time limit. It soon became apparent, however, that an extension of the period would be required. An extension was sanctioned, first to the end of May and later to the 17th June in the case of Drainage Authorities, and the 30th June in the case of County Councils.

A further extension of time was obtained in the case of certain sea-defence works on the Lincolnshire coast, involving an expenditure of £40,000 and providing employment for about 500 men. This work may not be finished much before the end of October next. In this case 50 per cent. of the cost of the scheme is to be repaid.

Results.—Having regard to the general conditions under which the work was to be done, viz., by men who were

presumably unaccustomed to working in or about watercourses, and especially to the unsuitability of the winter season for such work, no extravagant hopes were entertained as to the value of the results. So little confidence was felt by some of the larger drainage authorities that they abstained from submitting schemes.

The real value of the results actually achieved has been a most gratifying surprise to everyone concerned, and it is easy, after the event, to reflect wisely upon the fact that a large percentage of the men must have served a long and painful apprenticeship, whilst on Military Service, to the art of transforming swamps into "better 'oles."

Apart from sea-defence and water-supply schemes, which are referred to later, the great bulk of the work comprised the thorough clearance of channels by the removal of fallen or ingrowing timber or other accidental obstructions, and the improvement of their sections and gradients by cutting away cesses, bends and shoals, and the digging out of old-established weed roots; in a number of cases the straightening of sinuous courses was effected by the cutting of new channels (see Figs. 1 and 2).

Perhaps the most ambitious effort of the Drainage Authorities was that of the Middle Level Drainage and Navigation Commission, in demolishing an old brick-arched bridge, carrying the road between Wisbech and Downham over the Middle Level Drain at Outwell and building in its place an entirely new structure of steel and concrete (see Figs. 3 and 4). This work was carried out most successfully by Major R. G. Clark, A.M.Inst.C.E., Engineer to the Commission, with direct labour, mostly unskilled, and is in itself an eloquent testimony to the adaptability of all concerned to the conditions under which the work was undertaken.

Other notable achievements by Drainage Authorities were :— By the Welland Outfall Trust, the straightening, widening and deepening of the tidal portion of the River Welland over a length of about 10 miles from its confluence with the River Glen to about 5 miles above Spalding (see Figs. 7 and 8); by the Lugg Drainage Board, the general improvement on similar lines to the above of the main river and its main tributaries over a total length of about 32 miles; by the Ouse Drainage Board, a like improvement of important channels within their system, including those of the Thet, the Brandon, the Ivel and the Old Bedford river; by the Muston and Yedingham Drainage Board in the clearance and improvement of considerable

FIG. 1.—The River Anker, Warwickshire: A typical case of river straightening.

FIG. 2.—Meres Brook, Warwickshire: A typical case of stream cleansing.

FIG. 3.—Old Brick-arched Bridge at Outwell, Norfolk, in course of demolition.

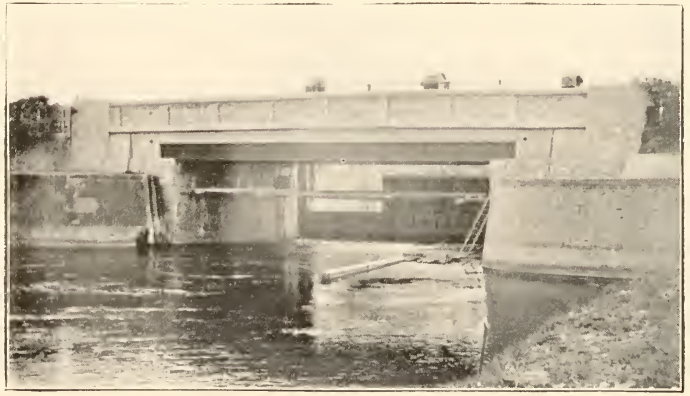

FIG. 4.—New Bridge constructed almost entirely by unskilled labour.

FIG. 5.—The River Derwent, Yorkshire: Arterial Drainage Channel before cleansing.

FIG. 6.—The River Derwent, Yorkshire: Arterial Drainage Channel cleared by hand labour.

FIG. 7.—River Welland at Spalding: Digging out Cesses and widening the Waterway.

FIG. 8.—River Welland at Spalding: Clearance of Channel completed.

FIG. 9.—Wick Sea-bank, Clevedon, Somersetshire: Showing undermining of Bank by Tidal Scour.

FIG. 10.—Wick Sea-bank, Clevedon, Somersetshire: Showing portion of Bank re-inforced with stone pitching.

lengths of the upper reaches of the River Derwent (see Figs. 5 and 6); and by the Loddon and Blackwater Voluntary Drainage Committee, whose improvements in the channel of the Loddon have been most marked and effective.

A large proportion of the works undertaken both by Drainage Boards and County Councils was for the protection of low-lying land from river or lode flooding by the erection of new or the reconditioning of old flood embankments of which some 70 to 80 miles have been dealt with.

Area No. 6 was responsible for the largest number of schemes submitted by any of the various groups of counties, the total number of drainage schemes being 76 and the total number of water-supply schemes 27, of which 66 and 27 respectively were submitted by the County Agricultural Committees of the counties concerned.

In Kent and Essex one-half the number of cases were for sea-defence. A very high tide which occurred on 1st November did considerable damage to the defences all round these coasts, about 45 miles of sea walls being affected. In a number of cases complete breaches occurred and about 17,000 acres of good grazing land were either actually overflowed or otherwise damaged by sea-water. Practically the whole of the damage has been repaired either by building inset or "shoe" walls round the breaches or by repairing and strengthening the less seriously injured defences.

The same and subsequent high tides in the Bristol Channel seriously menaced the security of about 6,000 acres of land lying behind the Clevedon sea-defences of the Somersetshire Commission of Sewers, and, although no actual breaches occurred, long lengths of the sea-walls were damaged and much of the supporting outmarsh washed away. In this case the walls have been raised and strengthened and their faces and toes protected with stone pitching supported by round timber piling (see Figs. 9 and 10).

Along the coast of Lincolnshire (previously referred to) between Ingoldmells and Mablethorpe, and on the Denbighshire coast at Rhuddlan Marsh, the new sea-defences consist principally of concrete stepwork and timber groyning. In the latter case the work was undertaken by the recently constituted Clwyd Drainage Board—a particularly active and practical body.

Timber groyning was also undertaken along the Pett Level frontage (Sussex) by the Commission of Sewers for the Peven-

sey Levels. Fortunately, this work and the general strengthening of the sea embankment were sufficiently advanced by 13th April to enable the defences to withstand an exceptionally high tide and gale which seriously threatened the works on that date. It has since been stated that, but for the work previously done, the whole of the Level would have been inundated to a depth of several feet with the probable loss of valuable grazing stock and other serious damage to agriculture.

Water-Supply.—Forty-six water-supply schemes were carried out, chiefly in the higher portions of counties where the long drought of 1921 had dried up springs and ponds and emptied wells. They ranged from the building of concrete reservoirs for the impounding of surface or roof-water to the sinking or boring of deep wells and the provision of power-driven pumps. In a few cases hydraulic ram installations were carried out. In practically all these cases, the estimated cost of materials was higher than that of labour, and the Ministry's grant covered the cost of unskilled labour only.

In the case of the Drainage and Sea-Defence Authorities the schemes were prepared and the work supervised by the regular technical officers of the bodies concerned, and these cases show, as might have been expected, better results on the whole than those which were prepared and supervised by County Officers, many of whom would not, of course, claim to be specialists in the kinds of work involved: but when that has been said it remains to be recorded to the high credit of the County Officers that the great bulk of their schemes were well considered, carefully estimated, and remarkably well executed. In the cases where the Councils had retained the services of their Drainage Officers there was almost nothing to choose between Drainage Authority work and County work.

The Men Employed.—Throughout the whole of the operations and in every part of the country the spirit displayed by the men has been excellent. A few isolated stories have been told of "street-corner boys" who have refused work at 32s. a week when they could get three-quarters of that amount for lounging, but 95 per cent. of the men have been only too anxious to be employed and there have been many hundreds of cases of men cycling or tramping many miles to and from work daily in all weathers rather than accept the dole or outdoor relief. The total number of men who have been engaged upon the works at one time or another cannot be less than

11,000, and there has not been the least trouble with them anywhere. The largest number employed during any single week was 8,165 for the week ending 6th May.

Where the site of the works has been within a short radius of an urban centre a fair proportion of townsmen have been employed, but taking the country as a whole, a summary of the Inspectors' reports indicates that from 80 to 90 per cent. of the men were genuine agricultural or other rural workers.

Analysis of Cases.—The following table gives an analysis of the cases dealt with in the various areas and the acreages estimated to have been benefited by the works :—

Area No	No. of Cases.			Submitted by :		Totals.	Approx. Number of Acres benefited.
	Drainage.	Sea Defence.	Water Supply.	Drainage Authorities.	County Councils.		
(1)	44	Nil		36	8	44	39,700
				—	—	—	—
			2	—	2	2	—
(2)	63			31	32	63	44,600
		7		4	3	7	10,500
			2	—	2	2	—
(3)	25			9	16	25	29,000
		3		—	3	3	2,500
			3	—	3	3	—
(4)	51			35	16	51	95,800
		2		2	—	2	12,000
			2	—	2	2	—
(5)	22			14	8	22	73,800
		32		8	24	32	17,100
			10	—	10	10	—
(6)	76	Nil		10	66	76	16,600
				—	—	—	—
			27	—	27	27	—
Totals	281	44	46	149	22	371	341,600

It will be observed that the number of drainage, sea-defence and water-supply schemes carried out by County Councils numbered 222 and that those carried out by Drainage Authorities numbered 149. The division of costs was not, however, in similar proportion, for whereas the total estimated cost of County Council cases was £83,000 or an average of about £374 per scheme, the total estimated cost of Drainage Authorities' schemes was £299,000 or an average of about £2,000 per scheme.

The actual expenditure on all cases will have fallen short of the total estimates by about £45,000, owing to a certain number of approved schemes not being proceeded with and to others having been carried out below the estimated cost. Exact figures, however, are not yet available. Taking the total expenditure at £338,000 to £340,000 it is interesting to note that this would represent just about £1 per acre over the areas benefited.

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A "CLEAN MILK" CENTRE AND WHERE TO FIND IT.

Major H. P. G. Maule, D.S.O., M.C., F.R.I.B.A.,
Ministry of Agriculture and Fisheries.

Articles in the July and August issues of this *Journal* have dealt with the plans and descriptions of new cow houses and farm buildings designed expressly for the purpose of producing milk under the best and most modern hygienic conditions. To many practical farmers struggling under the present adverse economic conditions such plans, involving considerable capital outlay, may seem a counsel of perfection which it were folly to pursue, but from the number of inquiries since received from various parts of the country, including Scotland, seeking further information, the writer is encouraged to hope that the subject may be further exploited without fear of loss of interest.

It is obvious that at the present time capital outlay on a large scale for farm buildings must be limited to comparatively few undertakings while, on the other hand, the heritage of the War with the enforced neglect of repairs and the high cost of building since 1919 have combined to retard the improvement and repair of existing buildings, though such are now urgently needed to ensure better and more profitable results from dairy farming.

The recent fall in the cost of building prices is naturally tending towards a revival of building activity, especially in making good long-neglected repairs, and the opportunity may now come to many to effect such slight alterations or additions to existing premises as may well enable the farmer to revolutionise his methods of milk production at very small capital outlay.

In many cases both landlords and tenants are unaware of the comparative ease and cheapness with which the adaptations can be made, and the necessary apparatus for sterilizing uten-

sils installed, for, as has been pointed out in this *Journal*, the human element is the most important factor, and elaborate buildings and costly fittings are not essential for the production of clean milk, provided that the arrangements are such as reasonably conduce to increased care and personal interest in the work on the part of the farm hands.

A recent visit to various farms in the Reading district undertaken under the auspices of the staff of the National Institute for Research in Dairying proved most instructive and convinced the writer that, given the requisite knowledge of what is essential, adaptation of existing buildings for the purpose of producing clean milk is a simpler and less expensive undertaking than many people are apt to imagine.

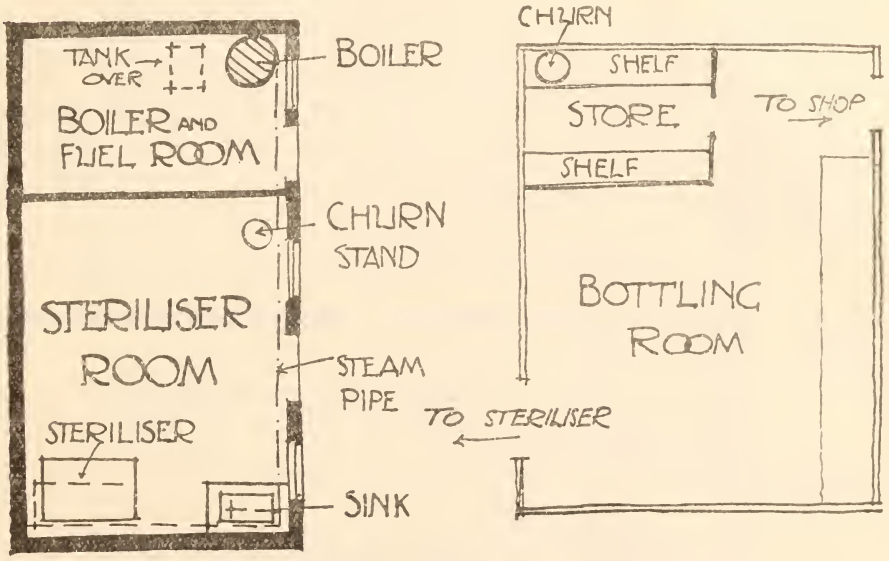

Fig. 1.—Old Stable adapted for Sterilizing Plant.

The purpose of this article, therefore, is to describe by means of rough sketch plans some of the small but significant improvements recently carried out at several old farms of the ordinary type, whereby the production of Grade A milk has become the normal procedure.

Fig. 1 illustrates the premises of Mr. J. J. Davis, of Reading, retailer of Grade A milk, and is instructive as showing how existing buildings may be adapted to entirely new purposes at small cost with profitable results. The plan shows an old stable converted into a boiler house and sterilizing room. The boiler, by Jenkins, of Rotherham, cost £35 complete and gives 50 lb. head of steam per square inch, 10 lb. being sufficient to

sterilize churns. This is placed in a separate compartment with water feed tank above, ample storage place for fuel being also available.

In the remainder of the building the plan shows the positions of the churn stand, sink, and galvanised iron sterilizer, the latter being 4 ft. 6 in. long by 2 ft. 6 in. wide and 2 ft. 6 in. high, to all of which steam is laid on from the boiler and controlled by the necessary valves.

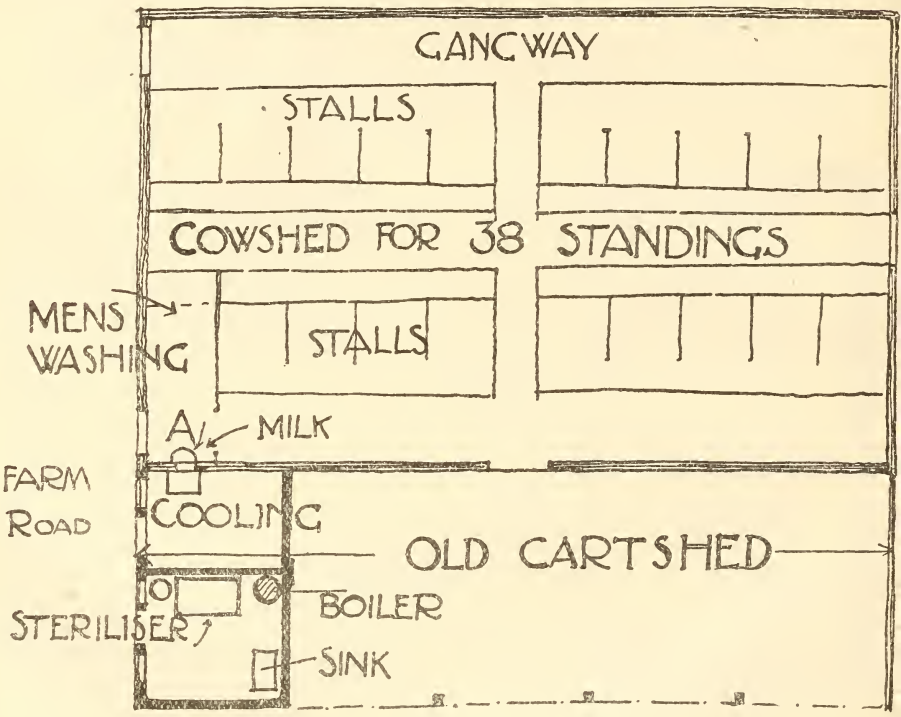

Fig. 2.—Hartley Farm, showing New Dairy.

Whitewashed walls, an impervious and easily cleaned floor and ample light complete the sterilizing equipment, which was carried out at a total cost of about £120.

A bottling room with small store room containing shelves for bottles, labels, caps, etc., is provided in an adjacent building. At the present time about 125 gallons of milk are handled per day. The simplicity and efficiency of this small plant are worthy of more general imitation.

Fig. 2 shows the improvements carried out at Hartley Farm for Mr. Bullingham, where Grade A milk is now regularly produced. The case is typical of the ease with which maximum

improvement in methods of production can be attained with the minimum disturbance of existing buildings.

In this case an existing double cowhouse had a lean-to cart shed adjoining, of which use was made to obtain the necessary dairy accommodation. The sketch plan shows how by the sacrifice of two stalls in the cowshed, a men's washing and overall room has been provided with direct external access. Here also the milk is weighed before it is poured into the receiver (marked A on the plan) which conveys it to the cooler in the adjoining but isolated cooling room.

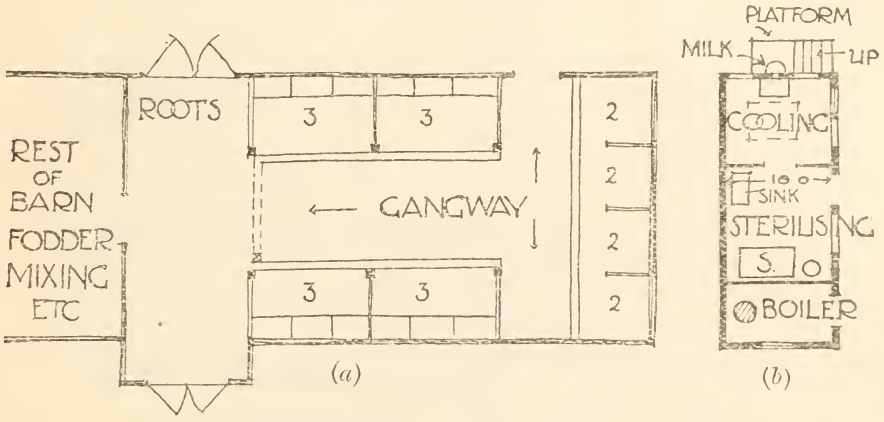

Fig. 3.—Beansheaf Farm : (*a*) Old Barn converted into Cowshed : (*b*) New Dairy.

The dairy has been formed by cutting off one bay of the old cart shed and dividing it into two portions. Nearest the cowshed but quite cut off from it, is placed the cooling and clean utensil room with ample light and direct external access. Adjoining is the sterilizing room, only 11 ft. by 10 ft., containing the boiler, sink, sterilizer and churn stand. Perhaps a slight improvement might have been made by isolating the boiler, giving access to it from the cartshed and thus minimising risk of dust and making the sterilizing room more convenient for working purposes, but the scheme as it stands is extremely simple and workable and has been carried out with the lowest expenditure in building costs.

Some 40 cows are kept, necessitating the employment of four milkers and one cleaner, and the instructive thing about this farm is the fact that the essential alterations for the proper and scientific production of Grade A milk, affecting such a large herd, could be made with so little disturbance to existing

buildings and yet be so adequate in effect as to revolutionise the methods of production.

Fig. 3 shows buildings at Beansheaf Farm, in the occupation of Mr. Cumber, where Grade A milk is also produced; it is instructive from two points of view.

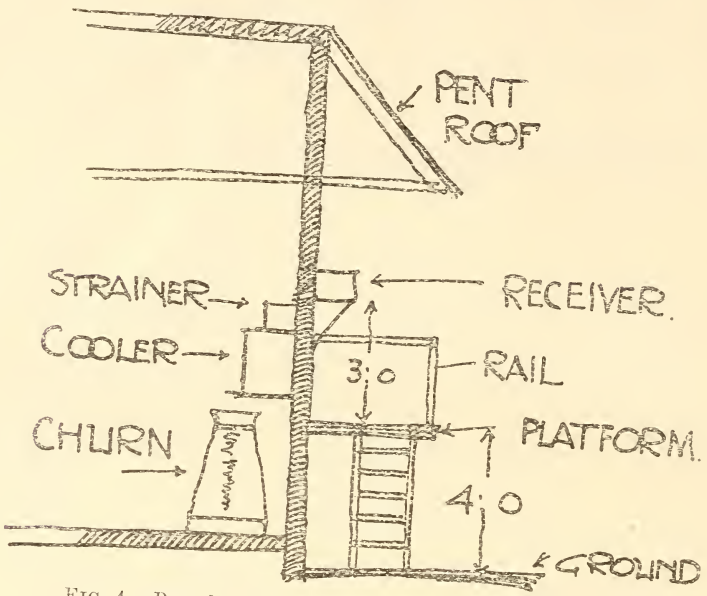

Fig. 4.—Beansheaf Farm : Section through Cooling Room.

In the first place the principal cowshed, containing standings for 20 cows, has been constructed out of a typical old-fashioned straw barn, and the cow standings generally, giving accommodation for some 40 cows in all, have nothing especially to distinguish them from thousands of others, save, perhaps, the care with which they are kept clean and the attention which is paid to hygienic detail.

In the second place, at this farm, it was found necessary to construct an entirely new dairy, yet the over-all size of this building, sufficient for the adequate handling of the milk of 40 cows, some 90 gallons per day, is only 30 ft. by 11 ft. 6 in., and owing to the scattered nature of the plan of the old buildings, it could not be placed with equally convenient access from all the cow sheds.

This point is emphasised in order to draw attention to the statement already made that the production of clean milk is not dependent upon elaborately planned modern buildings.

The dairy is placed conveniently for access from the main road and in close proximity to the adapted straw barn. The

accommodation comprises a small boiler house and fuel store, well lighted and placed at the opposite end of the building to the cooling room. Between these two, and with direct access to the cooling room as well as the roadway, is placed the sterilizing room containing the usual sink, steriliser and churn stand, the over-all size being 12 ft. by 10 ft.

Above the cooling room is placed a water storage tank. At the end is an external raised platform 4 ft. from the ground with pent roof over, and 3 ft. above this, on the end wall of the building, is the receiver through which the milk is poured into the strainer and cooler inside. A rough section (Fig. 4) shows the arrangement.

Approximately, some 90 gallons of milk are dealt with daily and the results so far thoroughly justify the outlay upon this efficient little building.

In conclusion, it may be said that the chief impression gained by this most instructive visit was the fact that in each case the best results in milk production have been secured by the simplest and most direct means. Nothing elaborate or costly has been done and what has been successfully attained might with equal ease be attained elsewhere, where the physical conditions of buildings and surroundings call for improvement.

It is impossible not to ascribe this improvement in the production of pure milk to the spread of education and the pervading influence of the National Institute for Research in Dairying, and it is hoped that the publication of these notes may induce others to follow the lead so ably set in the Reading district.

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THE SHIRE HORSE:

PAST, PRESENT AND FUTURE.

EDMUND BECK.

HAVING been invited to write an article on Shire horses for the Ministry's *Journal*, I propose to deal with the subject under the three headings, the Past, the Present and the Future.

The Past.—It will not be necessary to dwell on the past, for many able writers have dealt with the genesis of the Shire, tracing his ancestry to the Great War Horse that carried the knight to battle in the days when knights were bold. It may, however, be noted that in 1879 a Society was formed and a Stud Book instituted to further the breeding of the English Cart Horse, which then took the name of the Shire Horse. The society proved an immediate success and many of the ablest men in the country, both landowners and farmers, took up the breed and set about its improvement.

At that time, although the Shire was a weighty horse it must be admitted that there was considerable room for improvement, especially in his feet, legs and movement. A marked change, however, soon took place. Lincolnshire Lad II and his famous son Harold, What's Wanted and his son Premier, William the Conqueror and his sons Prince William and Hitchin Conqueror, Royal Albert, Bar None, Vulcan and Bury Victor Chief were all famous sires that did their bit in the earlier days of the breed. In later days Lockinge Forest King, Childwick Champion and Norbury Menestrel proved their worth, and it is interesting to students of pedigree to observe how full these three are of the blood of the old giants. Lockinge Forest King had three crosses of Harold, one of Premier, one of Prince William, and two of Royal Albert; Childwick Champion had three crosses of Lincolnshire Lad II and one of Premier; and Norbury Menestrel was of the combined blood of Hitchin Conqueror, Premier, Harold, Royal Albert and Vulcan. Other famous sires up to and including the present are Champion's Goalkeeper, Friar Tuck IV, Babingley Nulli Secundus and Champion's Clansman. The breed has produced many other good sires. It is only an expression of opinion, but if asked to say which of these sires has done most for the breed the writer would say that Lockinge Forest King holds chief place by reason of the beautiful mares and fillies that he sired, all of one type.

Photo.] [*G. H. Parsons.*

FIG. 1.—Shire Stallion, Field Marshal V.

Photo.] [*G. H. Parsons.*

FIG. 2.—Shire Mare, Crossways Forest Maid.

The Shire has been especially fortunate in its supporters, King Edward was one of the first to recognise it and maintained a stud at Sandringham and those great mares Dunsmore Gloaming, Solace and Victor's Queen, all bred there, are probably unequalled for a trio of mares bred at one stud. King George has carried on the traditions and his famous Stallion Field Marshal V, twice winner of the coveted London Championship, is now proving himself equally successful at the stud. Staunch supporters were Lord Rothschild, Lord Middleton, the Duke of Devonshire, Lord Egerton, Lord Powis, the Duke of Westminster, Sir Walter Gilbey, Sir Albert Muntz, Sir Walpole Greenwell, Lord Wantage and Lord Redesdale, some of whom are still with us.

Other names are familiar to Shire Horse Breeders—the famous Forshaws, Mr. John Rowell, Mr. Alfred Clark (our late and present honoured Presidents), Messrs. Edward Green, F. W. Griffin, Jas. Gould, Shaw, Whinnerah, etc. These are known wherever Shire horse breeders congregate, but it would make a lengthy list to name all the men who have given and are giving their best to the furtherance of the interests of the breed. Sufficient has been written to show the place occupied by the breed in the heart of British farmers.

The Present.—Following years of unprecedented boom we have had an equally unprecedented slump. During and for a year after the late War Shires realised extraordinary prices—prices that could not be justified even if the trade of the country had continued good—then, as with everything else came the slump.

Everything was against the horse: industrial trade was bad, enormous quantities of Army horses and Army lorries were thrown on the market, and tractors were the latest novelty. Prices for horses fell all round, croakers said the heavy horse was doomed, and even amongst Shire horse breeders some were doubters, although the wise old hands and the tenant farmers, the backbone of the breed, stood firm and never lost faith in their breed. In the spring of this year the bottom was reached and since then a very slow but steady improvement has to be noted in the horse trade, which is reflected in the demand for Shires.

In addition to the bad times which have fallen to the lot of all horse breeders, the Shire has had to face strong, and in most cases healthy, competition. The Suffolks, a much improved breed with an active and enterprising Society which neglects no useful propaganda has made great strides during the last few years. The Clydesdale which is all-powerful in Scotland

produces some grand geldings. The Percheron is mainly in the hands of rich amateurs and at present has not gained much ground among the tenant farmers of England.

Attacks on the Shire and his work during the War were made in the press but soon died out. The supporters of the Shire do not suggest that every heavy horse with hair on his legs that went to France was of superlative merit, but they maintain that for the heaviest draught work, there was no other breed to equal the Shire, and a very large proportion of the horses in the heavy gun teams were Shires.

Further competition must be reckoned with, and as in war the best defensive is the offensive every effort should be made to push the interests of the Shire. For example, much good would be done at the Suffolk, Essex and Norfolk Shows by strengthening the classes for Shires so that a good representative collection of the breed should be seen at these shows. Above all, at the Royal, the battle ground of the breeds, the classes should be well filled and with the best examples of the breed available.

It is gratifying to observe that the ruling spirits in the Shire world are taking steps to bring before the public at home and abroad the merits of their breed as a heavy draught horse. Unfortunately owing to the state of trade no immediate result can be looked for abroad, but efforts at home should soon bear fruit. The Gelding Class at the Royal, which was assisted by the Shire Horse Society and which brought out probably the finest collection of Geldings that has ever been seen, was a notable gathering. The parade of these horses was one of the most effective features of the Royal and the eighteen grand specimens of the finished commercial article made a great impression on the crowds who attended the Show. The Gelding has been rather the " Cinderella " of the breed, and it is hoped that further efforts will be made on these lines, as there is no doubt that money spent on this object by the Shire Horse Society is spent wisely and well. The announcement has recently been made that the Shire Horse Society is presenting the Canadian Government with a stallion and five mares. This should do much for the breed, and result in an increased demand in that great Dominion.

The Future.—We are convinced that there is a great future in front of the Shire if breeding is carried out on the right lines. The question arises, as it does in every breed, " Is too much attention given to fancy over utility points? "

Feather is an essential part of the equipment of a Shire, but is too much attention paid to the profusion of hair that appears necessary to win to-day?

Is there rather a tendency to "early maturity" in the breed, and are not some of our colts and fillies better animals up to three years old than they are in later years? If so, which is doing the most for the breed, the wonderful foal or yearling, or the horse that does not come to his kingdom until he is four or five years old?

It is everywhere admitted that the Shire has enormously improved in legs, feet and soundness, but is sufficient attention being paid to those equally important needs, depth through the heart, back and constitution?

Lastly, is sufficient attention being paid to that most important point, stallion and mare "character," that quality which it is almost impossible to define but which every great breeder of any class of stock is most strongly influenced by?

It would be presumptuous on the part of any one person to give decided answers to all these questions, but it is clear that no harm and some good may be done by Shire Horse Breeders debating the points raised. In the writer's opinion, if it is borne in mind that the whole, sole and only object of the Shire Horse Breeder is the production of magnificent geldings like those seen at the Royal and at London and Provincial Horse Parades there will be no necessity to ask such questions.

There is every prospect of Shire horse breeding being a pleasant and profitable part of a farmer's business in the future as it was in the past. There are signs of an increasing demand for heavy horses. Motor lorries are expensive, both in first cost and in maintenance, and there is no question that with the reduced price of forage the horse is the cheaper motive power for short journeys with heavy loads. We do not want and shall not see the extravagant prices for horses that prevailed (it was the high price for horses and forage after the War that induced many merchants and team owners to try the motor lorry) but we expect to see a ready trade at reasonably remunerative prices in the near future for the finished article, the gelding, and this is bound to react favourably on the Shire horse breeder.

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CALIFORNIAN METHODS OF POULTRY RAISING AND MARKETING.*

I.

It is a commonplace that the conditions under which many American industries have grown up have produced organisations different in many respects from those of Europe. The difference in conditions, however, has not been so great as to preclude the adoption in Europe of American methods, where these are found to be of value. Advantage has, in fact, so frequently been taken of American experience that it is the more remarkable that poultry-farming organisation in that country has hitherto been so little reflected in British methods.

That poultry-farming practice in the United States is worthy of investigation is shown by the following salient facts: that 22 million dozen eggs and 240 thousand dozen poultry were shipped in 1920 from a district in California some 50 square miles in extent; that a farm of 2,500 hens is considered to be one man's work; and that an annual net profit of $1.10 (normally 4s. 7d.) per hen is considered a somewhat low average.

It is true that the soil and climate of California are contributory causes of these arresting results, but they are by no means so important as is frequently held. The settlement which it is proposed to describe is only one of several in California, and the methods of all of them are common to most poultry-farming centres in America, even to those in the Eastern States, where the climate is less suitable than in England. Further, the methods and devices described below must not be regarded as the chief cause of prosperity: they are themselves the outcome of a business prosperity founded on three main principles—hard work, cleanliness, and attention to detail. There are no illusions in such communities regarding the exacting nature of the work necessary for success in poultry-farming, and unremitting attention is everywhere evident. The importance of cleanliness and adequate disinfection is also recognised. Dirt and disease are destructive of the results of so much labour that it has become an imperative business principle to avoid them. A continual application of these three principles has been a prime factor in creating the organisation which it is proposed shortly to outline.

* This report was drawn up by H.M. Acting Vice-Consul at San Francisco and was communicated through the Department of Overseas Trade.

This organisation has its centre at Petaluma, a town of some 6,000 inhabitants, situated near the northern extremity of San Francisco Bay. It is the headquarters of the small district which, as already stated, produced over 22 million dozen eggs in 1920, and although apparently the largest poultry raising community in the world, may be taken as typical of many similar centres throughout the United States.

Poultry Hatcheries.—The poultry-raiser of Petaluma usually obtains his stock from one of the "Hatcheries" of which there are several in the town. One of these, which may be taken as typical, hatched out one million chicks in 1921. The eggs are bought at about 10 cents above current prices by the hatchery, which is a business concern, and in no sense co-operative. The resultant chicks are sold at about three times the price of the original eggs. Eggs for hatching are bought from specially selected ranches known to the hatchery as possessors of highly productive strains; in some cases the hatcheries themselves supply cockerels, and are thus in very close touch with the pedigrees of the birds whose eggs they hatch. The incubators are arranged in tiers on racks in a large room and are heated by gas or electric appliances regulated by thermostats, of which there is one in each chamber. The air is kept comparatively moist by leaving the ground beneath the racks exposed, only the alleyways between being paved. This is scarcely sufficient for the upper ranges of incubators, and where necessary further moistening is provided by means of pans in the incubators. The eggs are turned by hand, the trays being grooved to make this task easy. The owners of the hatchery in question prefer this method to mechanical turning, as their experience shows that the mechanical method is productive of a considerable percentage of abnormal chicks. By the hand-turning method, combined, of course, with careful tending throughout the hatching period, an average hatch of 80 good chicks in every 100 is obtained.

When the newly-hatched chicks have been dried off they are placed in ventilated boxes containing 4 sections of 25 chicks each for delivery. Frequently, of course, local poultry farmers arrange to receive back the chicks hatched from eggs supplied by themselves, but large numbers of day-old chicks are sent considerable distances to the hatchery's customers. It is found possible to send day-old chicks on a 72-hour journey without injury or prejudice to their subsequent growth.

An interesting feature of the organisation of the hatchery under notice is that one of the partners, who is a qualified

veterinarian, is placed at the disposal of all purchasers of day-old chicks who live within a reasonable distance. If any trouble arises or if any advice is needed his services are invoked. This procedure is of great value to the hatchery both for purposes of advertisement, and because it ensures a larger percentage of survivals than would otherwise be the case. The veterinarian further justifies his existence by superintending a model poultry farm owned by the hatchery.

Brooding.—A great deal of attention is naturally given to the brooding of young chicks, and numerous types of houses and machines are in use. One of the favourite methods is by the use of what is known as the "Kresky" house. This consists of two rooms, one of which is kept heated at 75° F. by means of an oil stove and thermostat, the second being considerably cooler. A small entrance is provided from the warm to the cool room, and from the latter to the chicken-run, so that the chicks may accustom themselves to the different temperatures. The room floors are usually covered with some form of warm, dry litter, and the corners are rounded off to prevent suffocation of chicks by crowding into corners.

Trays of grit are placed in both rooms, and frequently a continuous water supply and food supply is provided.

This form of house appears very useful for large numbers of chicks. The owner of a "ranch" in Petaluma recently raised 6,000 chicks in four Kresky houses each room of which could not have been more than 20 ft. by 16 ft. Including the open-air "run," these 6,000 chicks were raised in an area of less than half an acre; and although their owner, having neglected to separate his cockerels at the earliest possible moment, was, in this case, risking loss by overcrowding, there is no doubt that chicks are brooded successfully in very confined areas. One square foot for young chicks and two square feet for hens and pullets is the room considered desirable here.

Various forms of smaller artificial brooders are in use. The majority of these are heated by oil or coal stoves. This method has the advantage of needing only one house, instead of two, as with the Kresky method. An electric brooder of orthodox design was also seen, the heat being supplied by wire coils beneath the floor of the brooder. In all cases regulation is provided by a thermostat which, in the case of the electric brooder, showed a small light when current was being used.

The size of the flocks of young chicks placed in the brooders is a feature of Petaluma. The batches vary from 500 to 6,000,

2,000 being a frequent quantity. The cockerels are separated at the earliest possible moment. Success is only due to detailed personal attention to such matters as feeding, ventilation, control of light, and care that the chickens do not damage each other by toe-picking, overcrowding and so on.

Houses.—The Chamber of Commerce of Petaluma encourages the use of trap-nests and modern hen-houses by means of egg-laying contests and kindred activities, while, as will be shown later, the methods of the co-operative egg-marketing association make it to the interest of the poultry farmer to use the most scientific methods possible. Many of the Petaluma ranches still retain the "Colony" type of hen-house with a common run for several houses, but these are being supplanted, whenever possible, by more modern types of houses. The scheme now being adopted is to provide a house accommodating some 3,000 hens, the house being divided into sections each holding about 250 birds. A separate run is provided for each section, and where possible, a double run system is used, the runs either being arranged on both sides of the house or divided longitudinally on one side only.

Trap-nest systems appear generally to be confined to ranches producing eggs for hatching, and the majority of the farmers rely on their experience in judging the qualities of a hen, combined with the system known as "Hoganising" (*i.e.* the handling test).

The houses of the poultry-farm owned by the hatchery described below may be taken as typical of the principle upon which Petaluma farmers work, though in practice possibly not many of the ranches are so scientifically organised throughout.

The houses on this ranch, some 50 ft. long by 20 ft. wide, are built to accommodate 500 hens. They are lighted by muslin-covered windows and by electric light. The roosting perches run lengthways, are movable, and on one level. They are wide enough for the hen to perch without grasping with the feet, as this form of perch is considered to be less tiring for the hen, and hence to contribute something towards its egg-laying capacity. Beneath the roost is a dropping board, some 3 ft. 6 in. from the ground and 12 in. below the perches. These arrangements leave the whole of one side and one end of the house for trap-nests, which are placed at a height of about 4 ft. from the ground, to make egg-collecting easy.

One trap-nest for every three hens is found to be sufficient, eggs being collected every hour, and credited to the

record of the hen. A bucket is suspended by a wire moving in front of the nests, so that no stooping or unnecessary labour is entailed. In so exacting a business as poultry-farming on this scale, such labour-saving devices are invaluable. Clean dry litter is kept on the floor and covered-in water-troughs are provided at a height of 18 in. to 2 ft. from the ground to prevent litter being scraped into the water. Feed mixtures are placed in a dry-mash hopper. It appears that the advocates of dry and wet mashes are fairly equally divided, though probably slightly more dry mash is fed on account of the saving in labour as compared with the wet mash, a dry hopper needing to be filled only once or twice per week. Where wet mashes are used they are mixed with green food to avoid wastage. Many successful farmers pay great attention to the supply of green food, care being taken to provide different varieties.

The problem of the fouling of land in Petaluma Valley is a comparatively easy one. The soil is almost everywhere a light, sandy loam, porous, and productive; the climate is mild and equable; and, the district being well provided with small hills, natural drainage is almost universal. Under these conditions the double-yard system can be used to the greatest advantage. A foul yard is ploughed up, limed, rested for a few days, and then sown with quick-sprouting seed. At the end of three weeks there is usually a growth some 6 or 7 in. high, and the hens can be turned on to this. It is thus possible to confine the birds to an area which they will completely foul in three or four weeks, and by carrying out the process described above, to keep a large flock of poultry on a very small tract of ground.

The Feeding Problem.—The dimensions of the poultry-farming industry here have resulted in simplifying the feeding problem also. There are several grain merchants established in the town who import their grain from the neighbouring Sacramento and San Joaquin Valleys by cheap water transport. They mix their feeds in Petaluma itself and by establishing carefully composed brands of uniformly good quality, have materially reduced the poultry-farmers' cares while ensuring a constant market for their goods. Most of the grain and meal seen in the repositories was of good quality and remarkably clean. It is a noteworthy result of the magnitude and intensiveness of the Californian agricultural industries—in fruit growing and dairying as well as in poultry-farming—that great importance is attached to the grading and branding of the

various products. The producers themselves are so well aware of the commercial value of a good reputation for their goods that they go to considerable trouble to keep their brand uniform in quality, and are the more ready to place confidence in the branded grades of producers of other articles.

The buyer of poultry foods in Petaluma is, therefore, almost always willing to trust to a known mixture and rarely finds his trust misplaced. He is able, in consequence, to free himself from the necessity of growing or mixing grain himself.

Culling.—Another point upon which stress is laid is the elimination of the unfit or "culling." Unfit or unpromising chicks and bad layers are weeded out constantly on the principle that food is lost if given to an unworthy bird. The average bird is expected to lay 120 eggs in a year, and if she falls below this standard by the trap-nest or other record, she is sacrificed without compunction.

Co-operative Sale of Eggs.—It is after the collection of the eggs that the poultry-farmer comes within the sphere of influence of the co-operative society known as the Poultry Producers of Central California Incorporated. Some 75 per cent. of the Petaluma farmers belong to this organisation, which concerns itself with the marketing of the eggs. The farmer is expected to clean the eggs if necessary with a wad of steel wool (this having been found to be by far the most effective and least injurious method) and to grade them according to their size, colour and degrees of dirtiness. He buys egg-boxes holding 30 dozen from the co-operative society, and delivers them himself, when packed, at the society's depôt. The society's organisation makes it capable of obtaining the best and most stable price possible for eggs, the receipts being credited to the farmer according to the quantity of eggs which he has delivered.

(To be concluded.)

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FARM INSTITUTES.

PART II.

In the August issue of this *Journal* (pp. 400-408) a summary was given of the training provided at four of the Farm Institutes which have been established in this country. A further four Institutes are described briefly below. One of these—the Chadacre Agricultural Institute—has been provided entirely through the generosity of the Earl of Iveagh, and is unique inasmuch as board and tuition are entirely free of cost to male students.

THE SOMERSET FARM INSTITUTE, CANNINGTON, Near BRIDGWATER.—Cannington Court, four miles from Bridgwater, is a large mansion held on lease by the Somerset County Council, who have had the premises adapted, furnished and equipped as a Farm Institute on the most modern lines. The history of Cannington Court is interesting and can be traced back to the middle of the 12th Century when it was occupied by nuns, living under the Rule of St. Benedict, who continued to follow their peaceful avocation within its precincts until the dissolution of the monasteries some 400 years later. Subsequently it became the residence of a noble family, then was used once again as a nunnery, and more recently has been an industrial school for Roman Catholic boys. Fragments only of the original buildings remain, however, the present buildings being partly 15th Century and mainly Elizabethan. Central heating and electric light have been installed, and the interior of the building, with its common rooms, class rooms and numerous bedrooms, has been completely transformed. When the extensions now in progress are completed, the hostel will accommodate 25 women and 25 men. The Institute should attract students from neighbouring counties as it is the only one of its kind in the south-west of England.

The Farm.—The farm, adjoining the Institute, covers 175 acres, about 80 acres being arable land—a medium loam, well adapted for cultivation and general demonstration—92 acres pasture and meadow land typical of the heavy alluvial soils adjoining the River Parrett, and 3 acres a grass orchard. The live stock include 7 working horses, 21 dairy Shorthorn cows, 71 ewes, which produced some excellent forward lambs this year, and 72 pigs—Gloucester Old Spots, Large Blacks and Wessex

Saddlebacks. The farm buildings, remodelled to secure economy in the housing and feeding of live stock and in the preservation of farmyard manure, have gravitation water laid on and electric light installed, and the dairy, fully equipped with modern appliances for the treatment of milk and the making of butter and cheese, is remarkable for its cleanliness, good order and business-like management

The Agricultural Course.—The agricultural course consists of three terms of 12 weeks each, thus covering a full year's farming operations. Whenever possible the lectures are given on the farm instead of in the lecture room and the students take part in all kinds of farm work, including dairying and horticulture. Mr. James Mackie, M.A., B.Sc. (Agr.), is Principal of the Institute and Agricultural Organiser for Somerset.

During the first term of the agricultural course, the student is instructed in the nature of soils, their adaptability, improvement, etc.; the use of the various kinds of farm implements and machinery; the rotation of crops, their harvesting and marketing; general science, including the structure and growth of plants; land surveying; and some aspects of horticulture. In the second term he will also study the use of manures, feeding-stuffs, plant nutrition, seed testing, the identification of plants and weeds and the first principles of book-keeping and farm accounts; and in the third will devote attention to the feeding, breeding and general management of live stock; veterinary science and the control of animal disease; the treatment of fungoid diseases; insect pests, and the cultivation of certain fruit and vegetable crops. The practical application of the teaching given during this course is emphasised and the whole of the instruction given is so designed as to be of immediate utility and application. It is meant primarily for the sons and daughters of farmers and those who propose to become farmers or farm managers.

The horticultural course consists of three terms of 12 weeks. Students take part, under the supervision of the horticultural staff, in all classes of work in the gardens and orchards, which are well stocked with tree and bush fruit. The aim of this course is to give a practical training in growing fruit and market garden crops for sale. The pupils will also receive instruction in bee-keeping, including practical apiary work, and will attend the classes in general science, land surveying and book-keeping, which will be supplemented by special lectures adapting this instruction to horticultural practice.

Dairying and Poultry Keeping.—The full course in dairying and poultry keeping lasts for 12 weeks. In addition to attending lectures and demonstrations, the pupils take part in practical work in milking, the handling of milk, and the making of butter and cheese. When the poultry section is more fully equipped, they will practise the fattening, killing and dressing of poultry for table and market. Domestic science is included in the women's course. An exhibition of the work of the several departments was arranged at the County Show at Bridgwater last May. No pains are being spared to make the Institute a success in its educational and—hardly less important in a school of this kind—its social aspect. The students are fortunate enough to enjoy the use of an open-air swimming bath, a tennis court and games equipment provided by the County Council.

Scholarships.—Two Farm Institute Scholarships in agriculture and one in horticulture are offered for competition annually, the holders being entitled to free tuition, board and residence for one year; two free Studentships in dairying are also offered each term. Two Senior Agricultural Scholarships tenable for two years at University College, Reading, or some other approved institution, may be competed for by students who have attended the Farm Institute course and intend to follow an agricultural calling.

CHADACRE AGRICULTURAL INSTITUTE, SUFFOLK.—This Institute is the gift of the Earl of Iveagh, who purchased the estate in 1920 for the purpose of founding and endowing an Institute at which the sons of agricultural workers, small holders, small farmers, etc., should be given instruction in the practical and scientific principles of agriculture. For students coming within the above description, training, board and lodging are free. In the summer months instruction is given to women in dairying, poultry keeping and horticulture; this is also free, but a charge is made for board.

Chadacre Hall will accommodate about 40 male students. It comprises large dining and recreation rooms, two lecture rooms, a chemical laboratory, and dormitories, and is fitted throughout with electric light.

The Farm.—The farm is 500 acres in extent, including a park of 100 acres containing fine specimens of shrubs and various trees, which is surrounded by plantations covering another 100 acres. Good opportunities are thus afforded for teaching forestry and woodman's work, and students are instructed in farm car-

FIG. 1.—Farm Institute, Chadacre: South-west View.

FIG. 2.—Farm Institute, Chadacre: Home Farm and Dairy.

pentry and joinery in the carpenter's shop, where the timber grown on the estate is utilized. 336 acres are under arable cultivation; the extensive gardens are laid out for market gardening, fruit growing, horticulture and bee-keeping. There are, in fact, four farms which are now being run as one. The soil is a heavy clay mixed with a small amount of chalk and flints. Much of the land is in poor condition, especially the pastures, but already where slag has been applied the beneficial effect on the wild white clover is very marked. The arable land has apparently been ploughed at a shallow depth for many years, and it is intended that a certain proportion of the land each year shall be steam cultivated or sub-soiled when ploughed in order to break up the pan. Up to the present 70 acres have been so treated. Most of the fields, moreover, are wet, and part of the land will be mole-drained each year: 60 acres have already been done. Green manuring and forage cropping are practised. The students will learn many useful lessons from the various measures which are being taken to improve the condition of the farm.

Courses of Instruction.—The aim of all courses of teaching and training at the Institute is instruction in farming as a business and in farming operations as a means of livelihood with a view to turning out skilled and intelligent workers. The estate and lands are worked, farmed and run, on practical lines for profit, with a full staff of workers, and the employment of pupils in the Institute is directed to giving them not only a practical acquaintance with the ordinary operations connected with a farm or garden, but also instruction in the underlying scientific principles. The teaching given at the Institute extends to carpentry, saddlery, implement repairing, basket making, etc.

The Winter Course for male students consists of two winter sessions of about six months each, commencing at Michaelmas and ending at Lady Day. Students are therefore able to return to their homes at a busy time of the year and to work on the land until the end of the harvest. Such a method benefits the small farmer by giving him the services of the pupil when these are most needed, besides keeping the pupil in touch with his home surroundings and giving him the opportunity to put into practice knowledge acquired at the Institute.

Farm classes are a special feature of the instruction and include a practical demonstration of every matter dealt with in the class room, *e.g.*, ploughing, sowing, marketing, hedging, ditching, thatching, the use of different kinds of machinery, stock judging, buying and selling stock, the estimation of the value

of corn, straw and hay in stacks, and roots in clamps. Occasional visits are made to Bury St. Edmunds Auction Mart for the study of live stock, and to farms having special features of interest.

The course of instruction includes agriculture; agricultural science; land measuring and mensuration; farm accounts; veterinary hygiene; farm implements and machinery; joinery and carpentry work; smith's work; horse shoeing; dairying, including production of *clean* milk; poultry keeping, bee-keeping, etc. Practical instruction is given in horticulture, marketing, butter making and milk testing, as well as demonstrations in cheese making, poultry trussing, etc. In the more advanced stages, the practical work includes feeding stock and compounding rations, and examining and identifying food stuffs, artificial manures, grass, clover, cereals and their seeds.

Two summer courses for female students in dairy work and poultry keeping are held, commencing in April and June respectively and lasting for nine weeks. Practical instruction is given in milking, separating, milk testing, butter making, and the making of hard cheese and cream cheese. Lectures and practical instruction in poultry keeping are also given, the course being specially suitable for farmers' daughters and others who propose to take up this branch of work.

THE HAMPSHIRE COUNTY COUNCIL FARM INSTITUTE.—From 1900 to 1914 the Hampshire County Council Farm School was established at Old Basing, near Basingstoke, but towards the end of this period, owing to the increasing demand for agricultural education it was removed to its present position at Sparsholt. The Institute is situated on high ground four miles north-west of Winchester, and is therefore central, both for the County, and for the Headquarters of the County Council. The Principal is Mr. L. G. Troup, B.Sc. (Agric.). Thirty residential students can be accommodated. Between 50 and 60 students have attended the Farm Institute annually during the past few years.

The Farm consists of 250 acres of land overlying chalk, and is typical of much of the land in Hampshire; roughly half of the land is arable. A herd of about 30 dairy Shorthorn cows is maintained by the rearing of young stock, and is being graded up by the use of good bulls. Clean milk production is practised, and the tuberculin test has been carried out. A

number of steers are reared and fattened off at from 16 to 21 months old. A small breeding flock of pedigree Ryeland sheep is kept, and additional sheep are bought as required. The nucleus of a herd of Large Black pigs has recently been obtained, and there is a considerable number of cross-bred pigs on the farm. Field work is carried out both by horses and tractor.

Additions made to the farm buildings during the past year include a dutch barn, an implement shed for demonstration purposes, stock boxes, a large covered yard, and a new food preparing machinery and administrative block.

The Gardens extend to 5½ acres, and were laid out in 1914 for ordinary hard and soft fruit and vegetable culture. A greenhouse is also available. The Dairy is equipped with apparatus for steam sterilization in addition to that for making hard and soft cheeses and butter. The Poultry Department has been greatly improved recently, and provides facilities for complete instruction in the various branches of this subject. Four utility strains of different breeds are kept, and ducks have recently been added. The Bee department consists of about 25 stocks. In addition to providing instruction in this subject to students, the department distributes a considerable number of nucleus stocks to bee-keepers in the County during the season.

Courses of Instruction —The work of the Farm Institute is largely practical, only sufficient lectures being given to give students a basis of knowledge on which to work. Instruction is given in agriculture, horticulture, dairying, poultry-keeping, farriery, farm engineering, book-keeping, veterinary hygiene, carpentry, etc. The session is divided into 3 terms, viz., autumn and spring terms of 12 weeks each, and a summer term of 15 weeks.

All students taking general agriculture and allied subjects are recommended to take the one-year course, which commences in October. In this way the operations extending over a complete year can be followed. A six-months' winter course is provided for farmers' sons who can only be spared from home during the winter.

A one-year course for the British Dairy Farmers' Association examinations in butter and cheesemaking is recommended to students who intend to take dairying posts, and is also recognised as an approved preliminary course for the National Diploma in Dairying.

Special courses can be arranged in one or more subjects if desired. Short courses in dairying, horticulture, bee-keeping, and poultry-keeping are arranged during the summer.

Experimental Work.—A considerable amount of experimental work is carried on both on the farm and in the county, and the results are published annually. The importance of such work to students cannot be too strongly emphasised, as owing to their assisting with the experiments, the faculties of careful observation and thought are strongly developed. Visits to farms in the neighbourhood are arranged when possible, and lectures by specialists in agriculture are given at the Farm Institute during the winter.

Scholarships.—Six scholarships for the winter course are awarded annually to boys over 15 years of age, entitling the holders to free instruction, board and residence for 24 weeks. Preference is given to the sons of Hampshire farmers, dairymen or others connected with the land.

Young men and women who have attended a course of lectures in horticulture in the county are eligible to compete for three scholarships for a six months' course in practical horticulture.

Twelve scholarships for a five-weeks' course in dairying are also offered. An examination is held at the close of the winter course to decide the award of two scholarships tenable at the University College, Reading, for a six-months' course. Certificates are also awarded as a result of this examination, to students reaching the required standard.

MOULTON FARM INSTITUTE, Near NORTHAMPTON.—The village of Moulton, on the outskirts of which the Farm Institute stands, is situated in the centre of the county, 5 miles from Northampton. At Michaelmas, 1915, the Northamptonshire County Council became the tenants of Moulton Grounds Farm; since 1920 they have been the owners of the freehold, formerly vested in the Wantage Trustees. A property adjoining the farm, consisting of two detached houses, four cottages, gardens and some grass paddocks, was acquired in July, 1919, by the Council, who have erected in the grounds, with a commendable economy in expenditure, laboratory, teaching and sleeping accommodation. All the residential places at the Institute available, which can take 16 male students at one time, were filled for the main winter course, and, in addition, 4 students attended for instruction only. The Agricultural Organiser, Mr. W. A. Stewart, M.A., B.Sc. (Agr.), who is also

Principal of the Farm Institute, lives in one of the houses; the other, "Southolme," which has lately been enlarged, is occupied by the domestic staff and contains, besides rooms for the warden, matron and teaching staff, the students' dining room, common room and recreation room. There is a playing field on the farm and games are encouraged.

The Farm.—The farm is 168 acres in area, the soil for the most part varying from light loam to heavy clay, one-third being typical Northampton sand; the land is clean and hedges and boundaries are well looked after. Of the 110 acres of arable land rather more than half is under corn. Trials are carried out with different varieties of cereals and roots, and experiments are conducted in the manuring of crops and the feeding of stock. During the years 1919-20 and 1920-21 the farm was run at a profit—an unusual feature among institute farms at that period.

A special feature is made of live stock on the principle of building up from small beginnings. The cattle are dual-purpose Shorthorns, mostly of Cumberland and Westmorland breeding. Calves are reared and milk records are kept. A few of the cattle are pedigree and it is proposed to grade-up and ultimately to register in the Shorthorn Herd Book. The Principal has been able to acquire an exceptionally fine lot of cattle. He is in close touch with the breeders of pedigree stock of all kinds, of whom there are many in the county, and who are always willing to allow the students to inspect their herds. The pigs are registered Large Blacks, kept on a modified open-air system mainly on the arable land. Draft auction sales, an innovation that might well be extended to other Farm Institutes, were held on the farm in 1920 and 1921 and helped materially to bring the work of the Institute to the notice of the farming public who attended in large numbers.

The light land is particularly suitable for the folding of sheep and a flock is maintained during the winter, chiefly on arable land crops.

The horses are of Shire blood: breeding is engaged in as circumstances permit. A flock of poultry (White Wyandottes) is kept.

The Courses of Instruction.—The primary object of the educational work is to provide instruction in the principles underlying the practice of agriculture, with special reference to the manuring of crops and the feeding of stock, to the study of farm book-keeping and the application of business principles

to agriculture. A winter course of instruction is held from October to March. The students are able to observe the results of various experiments and demonstrations on the farm, whilst in the laboratories practical work is carried out in soil analysis, seed-testing, etc.

There is a fruit plantation and market garden having an area of 2 acres. Here market garden crops are grown between fruit trees on the Evesham system, which enables the grower to employ horse-drawn or motor-drawn implements, and ensures a return even when fruit crops fail. Practical work in horticulture also includes propagation by cuttings, layers, grafters and budding. Inasmuch as the produce of the plot is graded and packed and disposed of commercially, students have the opportunity of observing every process from the preparation of the land to the marketing of the crop.

A summer course in dairy farming and poultry-keeping—attended this year by 12 women—is also held; other short courses are arranged as and when occasion demands. Pupils are taken at the farm in preparation for the winter course and at other times during the year.

The Committee are prepared to consider the admission at reduced fees or without charge of a limited number of students who are competent to benefit by a course of instruction at the Institute but whose circumstances are such that they cannot pay the full fee.

FIELD EXPERIMENTS WITH ROCK PHOSPHATES AND BASIC SLAGS.*

I.

G. S. Robertson, D.Sc., F.I.C.

Some ten or twelve years ago the Basic Open Hearth Process of manufacturing steel was introduced, and as it had the advantages of being more economical than the Basic Bessemer Process and of permitting the more extensive use of our lower grade ores, it has now almost replaced the older process.

Basic Slag.—The slag which results from the new process is still, to the steel manufacturers, a "basic slag," but it is no longer the "basic slag" with which the farmer has become so familiar and to which he attached so high a value. It contains a much smaller percentage of phosphate, the phosphates are of a different type, and in many instances they are far less soluble than those of the old Basic Bessemer Slag.

For practical purposes basic slags now obtainable may be divided into three types:—

Type (1) *High Grade*, containing from 33 to 42 per cent. of phosphate. A part of this supply consists of the rapidly diminishing remnants of the Basic Bessemer Slag, and agriculturists must face the probability of the complete disappearance of this class of slag.

Type (2) *Open Hearth Basic Slag*, containing from 15 to 32 per cent. of phosphate.

Type (3) *Open Hearth Fluorspar Slag*, containing from 15 to 32 per cent. of phosphate.

Types 1 and 2 have a citric solubility of from 80 to 95 per cent. and may be safely taken to be of equal value per unit of phosphate.

Type 3 has a citric solubility of from 6 to 50 per cent., and it is this type of slag which is of uncertain value. It is impossible to distinguish Open Hearth Fluorspar Slag from the other types by appearance, and if a purchaser wishes to avoid buying basic slag of this type it is only possible to do so by obtaining a solubility guarantee.

How much of the present supply is of the Open Hearth Fluorspar type it is not possible to say, but it is certain that the proportion is likely to increase in the future, and as it is

* This Article is based on a monograph on "Basic Slags and Rock Phosphates by Dr. Robertson, recently published by the Cambridge University Press. The Ministry is indebted to the Syndics of the Cambridge University Press for permission to utilise Tables 2, 3 and 4 and Figs. 1 to 5.

only a by-product there is no likelihood of it ever being worth the steel maker's while to modify his processes in order to produce a basic slag similar to that which has been in use in the past.*

Mineral or Rock Phosphates.—One of the possible substitutes for the old type of basic slag is ground mineral phosphate. Like basic slag, rock phosphates are basic in character; they have the advantage of a very high content of phosphate—from 50-88 per cent., depending upon the source. On the other hand they are considerably less soluble in citric acid than the high-grade basic slags, but are better in this respect than the new open hearth fluorspar slags. Experts differ as to the extent to which citric solubility may be taken as a measure of the relative value of such types of phosphates, and the matter can only be settled by extensive field trials.

It is important to remember that the various rock phosphates are not identical in character—they differ not only in their source but in chemical composition and in solubility in citric acid. In the following table the various rock phosphates are set out in the order of their solubility and their origin; their approximate content of phosphate is also indicated :—

TABLE I.

Name of Phosphate.	*Origin.*	*Approximate content of Phosphate.* per cent.	*Citric Solubility.* per cent.
Gafsa	North Africa	56—64	38
Egyptian	,, ,,	56—60	35
Algerian	,, ,,	58—66	33
Florida Soft	United States	48—54	27
Tunisian	North Africa	54—60	24
Tennessee	United States	30—60	23
Nauru	Oceania	82—88	21
Makatea	Oceania	82—86	19
Florida Pebble	United States	70—76	18

In general, the higher the percentage of phosphates in these natural phosphates the lower is their citric solubility. In this respect there is a great difference between Gafsa phosphate at the head of the table and Makatea and Florida Pebble at the bottom. It is, therefore, necessary to take such facts into consideration when planning field experiments, as it may well

* A Committee has been appointed by the Minister of Agriculture to study the problem thus created. Two reports of the Committee have been issued, the first of which was summarised in this *Journal* for September, 1921, and the second of which follows this article at p. 530. These reports contain among other information a summary of the results of field trials with slags now obtainable.

prove as important to distinguish between the extreme types of rock phosphates as between those of basic slag.

The Essex Experiments.—It was with the above considerations in view that the Essex Experiments were designed and laid down in the period 1915-19. As far as possible the various types of basic slag likely to be produced in the future were included in the field trials, and also a number of rock phosphates. Meadow land was chosen for the experiments because such land in Essex does not as a rule receive artificial manures. The soil was known to be poor in phosphoric acid, and a good response to phosphates could, therefore, be anticipated. Moreover, it is on grass land, whether hay or pasture, that the direct and indirect response to phosphates is most clear. The plots were one-quarter of an acre in area. Three types of basic slag have been used—Basic Bessemer, Basic Open Hearth Slag and Basic Open Hearth Fluorspar Slag—and these have been compared with the following rock phosphates:—Florida Pebble, Tunisian, Algerian, Gafsa, and Egyptian, and Cambridge Coprolites. At some of the centres plots dressed with superphosphate, with superphosphate and lime, and with lime alone have been included. The phosphates were applied during the period December to February. Unless specifically mentioned the initial dressings of the various phosphates contained 200 lb. of phosphoric acid per acre (approximately equal to 10 cwt. per acre of a 38-40 per cent. basic slag). No further dressing of phosphates was applied at any time during the course of the experiment and no other artificials have been applied to the plots. The hay crop was cut and weighed at each centre over a period of years, the whole of the crop being weighed on each plot immediately before stacking.

Eight experimental centres were laid down, the following soil formations being represented: London Clay, Boulder Clay and Chalk. The results from three of these centres are given below as they suffice to show the chief results obtained and the main conclusions drawn from the experiments.

Martins Hearne Farm: Boulder Clay Soil.—The experimental field at this farm had been down in grass for at least eighty years before the experiment began. During that period no artificial manures had been applied, but the meadow had received during the last twenty years at intervals of seven to eight years a dressing of about ten loads of farmyard manure per acre. The herbage was of the poorest character. The results

for the five years 1917 to 1921 are shown in Table 2 and are illustrated in Fig. 1 :—

TABLE 2.—WEIGHT OF HAY AT MARTINS HEARNE FARM.
Manures sown : 20th February, 1917.

Plots ¼ acre	MANURE 200 lb. P_2O_5 per acre	Citric solubility of phosphate, per cent.	HAY (in cwt. per acre).					
			1917	1918	1919	1920	1921	Average 5 years
1	Open hearth (fluorspar) basic slag	20·1	23·0	28·6	16·4	28·4	9·9	21·3
2	Open hearth basic slag ...	91·2	30·4	33·4	27·0	31·9	13·4	27·2
3	No manure	—	14·3	23·4	10·4	23·0	9·4	16·1
4	Gafsa rock phosphate ...	38·6	23·8	38·6	24·8	35·2	15·6	27·6
5	Egyptian rock phosphate	35·0	22·8	35·9	21·9	29·0	10·8	24·1
6	Algerian ,, ,,	35·7	23·2	35·0	21·0	34·6	12·7	25·3
7	Farmyard manure* ...	—	—	—	—	40·3	15·5	—
	Rainfall, May 1st till harvest (in inches) ...	—	6·27	11·51	2·85	8·37	2·44	
	Plots cut	—	July 23	Aug. 10	July 9	Aug. 9		

* Applied at the rate of 10 loads per acre in the autumn of 1919.

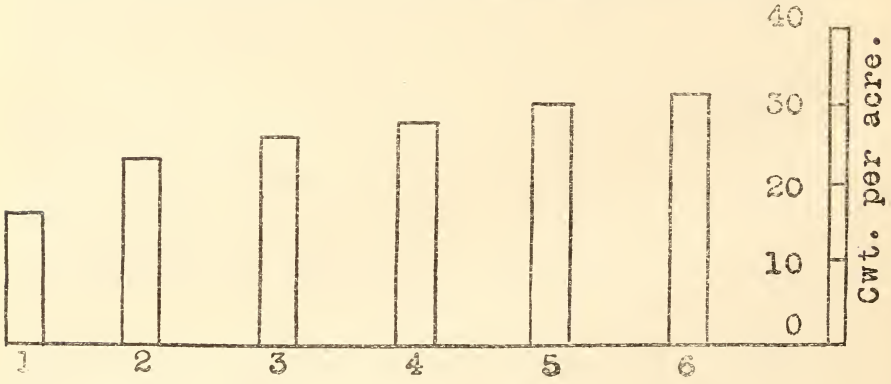

FIG. 1.—Yield of Hay (average of 4 years) from the various Phosphate Plots at Martins Hearne.
1, Untreated. 2, Open Hearth (fluorspar) basic slag. 3, Egyptian phosphate.
4, Algerian phosphate. 5, Gafsa phosphate. 6, Open Hearth (high sol.) basic slag.

The improvement which followed the application of the various phosphates was very marked indeed. During 1917 a mat of wild white and red clover began to cover the plots, and during 1918 it was so thick on some plots as almost to exclude the grasses.

As will be seen from Table 2 the high soluble slag proved considerably more effective than the open hearth fluorspar slag (low soluble) throughout the whole course of the experiment.

FIG. 2.—Martins Hearne, 3rd June, 1918. Plot 3, untreated.

FIG. 3.—Martins Hearne, 3rd June, 1918. Plot 4, treated with Gafsa Phosphate.

FIG. 4.—Horndon-on-the-Hill, July, 1920. Plot K, untreated.

FIG. 5.—Horndon-on-the-Hill, July, 1920. Plot H treated with Cleveland Phosphate.

On the average of 5 years the Gafsa phosphate has proved just as effective as the high soluble slag, and, although not quite so good, Algerian and Egyptian phosphates follow closely behind.

During the season of 1919 clover did not make its appearance on any of the plots. The rock phosphate and basic slag plots could, however, be clearly distinguished from the untreated, even at a distance, by their healthier green colour. In 1920 clover was present in the hay crop on the basic slag and rock phosphate plots to the extent of from 27-35 per cent. of the crop by weight.

Horndon-on-the-Hill: London Clay.—The soil is a heavy London Clay containing a small reserve of calcium carbonate (0.25 per cent.)—the residuum of the heavy dressings of past times. The soil is exceedingly heavy and impervious and is known in Essex as "three horse land." It is always put up into 7 ft. 6 in. stetches, to secure the maximum amount of drainage. The experimental field, like all fields whether grass or arable on this type of soil, lies cold and wet during the autumn in spite of the fact that the annual rainfall is only 20 in.—the lowest in the country. The summer is equally trying—the dry and hot weather which is usually experienced in Essex in June and the latter part of May "caps" or bakes the soil. It is but seldom that the crop of hay exceeds 10 cwt. to the acre and it is only too frequently left uncut altogether.

The experimental field was laid down to grass in 1890, and until the experiments started had received no manurial treatment of any description.

In this experiment an attempt was made to ascertain whether better effects could be obtained from rock phosphates by finer grinding. With this object in view the Florida Pebble, Algerian, Gafsa, and Tunisian phosphates used were specially ground.

All the phosphates were passed through a Griffin Mill for "coarse grinding," the mill being adjusted to give the standard usual for the manufacture of superphosphate (90 per cent. to pass a 60 sieve). In actual fact about 80 per cent. of the material will pass a "100" sieve, *i.e.*, a sieve with 10,000 holes to the square inch. For fine grinding the mill was closed down so that the output per hour was reduced by one-half. A much finer product was obtained, but owing to the "woolly" nature of the rock phosphates it has not been practicable to distinguish satisfactorily by means of sieves between the "fine" and the "coarse" grinding.

The results are set out in Table 3 :—

TABLE 3.—WEIGHT OF HAY AT GREAT MULGRAVES, HORNDON-ON-THE-HILL.

[Dressing 200 lb. P_2O_5 per acre unless otherwise stated.

Plots	MANURE	Citric solubility of the phosphate, per cent.	HAY (in cwt. per acre).		
			1918 *	1919	1920
A	No manure	—	—	Plots grazed by cattle and sheep.	4·5
B	Cambridge coprolites	25·0	—		15·9
C	Lime at rate of 1 ton per acre ...	—	—		5·0
D	Rough slag (double dressing) ...	—	—		17·2
1	Florida pebble phosphate (fine) ...	19·2	14·2		17·0
2	,, ,, ,, (coarse)	18·2	13·7		14·7
3	Algerian phosphate (fine) ...	35·7	14·7		21·5
4	,, ,, (coarse) ...	33·4	14·9		19·7
5	Open hearth basic slag : high sol.	91·2	18·8		23·2
6	No manure	—	11·1		6·4
7	Gafsa rock phosphate (coarse) ...	38·6	17·8		22·3
8	,, ,, ,, ,, ...	38·6	18·4		22·2
9	Tunisian ,, (fine) ...	26·0	17·9		23·2
10	,, ,, (coarse) ...	23·9	19·2		23·8
11	Egyptian ,, (fine) ...	37·0	23·6		23·6
12	,, ,, (coarse) ...	34·7	22·5		25·1
13	Superphosphate (200 lb. P_2O_5 per acre)	—	27·0		23·0
14	Superphosphate (50 lb. P_2O_5 per acre)	—	25·9		12·3
15	Superphosphate (200 lb. P_2O_5 per acre)—1 ton of ground lime per acre	—	23·4		27·2
16	No manure	—	15·5		6·4
17	Open hearth basic slag : high sol.	91·2	22·5		28·8
18	,, ,, ,, fluorspar sol.	20·1	18·8		16·8
19	1 cwt. ferrous sulphate per acre ...	—	13·6		6·4
E	Lime at rate of 1 ton per acre ...	—	—		5·4
F	Cambridge coprolites	25·0	—		15·1
G	Rough slag	—	—		10·4
H	Cleveland phosphate	18·9	—		19·0
K	No manure	—	—		5·0
L	Florida soft phosphate	—	—		13·0
	Average gain, Plots 1 to 5 and 7 to 13 and 15, 17 and 18, over plots 6 and 16	—	—	—	25 %
	Rainfall, May 1st till harvest (in inches)	—	2·25	1·78 †	5·34
	Date of cutting	—	July 8	—	Aug. 16

* Phosphates not applied till Feb. 28th.
† Rainfall, May 1st to June 30th.

The Basic Slags, and the Gafsa, Algerian, and Egyptian phosphates, were from the same bulk as those used in the previous experiments.

The various phosphates were applied too late in 1918 for them to have much effect that season. During 1919, a dry season, the

plots were grazed by cattle and sheep in order to secure a close grazing bottom and so protect and keep the surface soil cool. In 1920 the meadow was reserved for hay, and throughout the season the plots were visited at least every week, a close watch being kept on the progress of the various plots. The high soluble slag and the "superphosphate and lime" plots were the first to make a start, followed by the plots that received the finer ground rock phosphates. During the whole of May the superiority of the plots receiving the finer ground rock phosphates over those receiving the same phosphates, only more coarsely ground, could be distinctly seen. As the season progressed the distinction became less and less visible, until at the beginning of July it was quite impossible to see any difference.

The high soluble basic slag (Plots 5 and 17), and Plot 15 (superphosphate and lime), were distinctly ahead during the whole season, but the rock phosphate plots gradually lessened the difference as the season progressed, although they never actually succeeded in catching up.

When the wild white clover came into flower the effect was remarkable. Figs. 4 and 5, showing Plot K (untreated) and Plot H (Cleveland phosphate) give some idea of the contrast which met the eye. So thick was the crop of wild white clover that the farmer decided to cut the plots for seed.*

Plots 1-19 are strictly comparable, having been sown at the same time, and a useful comparison of the effectiveness of the various phosphates may be made from the yields of hay.

There can be little doubt that the highest soluble types of open hearth basic slag and basic superphosphate are the most effective phosphates at Horndon. Some of the rock phosphates, however, were nearly as effective. The hard American Florida Pebble phosphate was inferior to the softer North African phosphates, as not only was shown in the weights of hay, but was plainly to be seen on walking over the plots.

No gain from fine grinding is apparent in the weights of hay, but an earlier start was undoubtedly made by the plots receiving the finer ground phosphate, and where a meadow is reserved for grazing it is possible that the extra cost of grinding would be well repaid.

The open hearth fluorspar slag, after giving promising results during the first two years, proved a poor plot in 1920 when compared with the high soluble slag, Plot 17. All the rock phosphate

* Only the *plots* were cut for hay, and no attempt was made to harvest the rest of the field, as the crop was not considered to be worth the labour involved in doing so.

plots, with the exception of the two receiving Florida Pebble, were much superior to the open hearth fluorspar basic slag.

Plots C and E unmistakably show that lime without phosphate has little or no effect in improving this type of pasture.

It is difficult to interpret the results from Plots B, D, F, G, H and L. They were not sown until 1919, and the exceedingly dry season prevented a rapid response.

It has been quite obvious during the past two years that the light dressing of superphosphate on Plot 14 has not been effective. The improvement was much less than the weight of hay would appear to indicate, and during the seasons 1919 and 1920 Plot 14 looked very like an untreated plot. The heavy dressing of superphosphate on Plot 13 was much more effective. It was not, however, nearly so good as the high soluble slag plots or the "superphosphate and lime" plot. Even on a soil of this character, very deficient in phosphoric acid and with a small reserve of calcium carbonate, an acid manure like superphosphate is not suitable. On Plot 15 the same dressing of superphosphate as on Plot 13, namely 200 lb. P_2O_5 per acre, and one ton of lime per acre, were sown together. Under such circumstances the reversion of the water-soluble phosphate in the superphosphate would be practically instantaneous and the dressing would become a basic one comparable to the application of a dressing of basic superphosphate. It is of interest to note that Plot 15 gives results practically identical with those secured on the plots receiving the most soluble type of basic slag. A close observation was kept on Plots 15 and 17 throughout the 1920 season, and the only noticeable difference was the somewhat earlier start made by Plot 15. The difference in this respect was not great, probably not more than 7 to 10 days, and had visits to the plots been less frequent, might have been entirely overlooked.

Butcher's Farm, Lambourne End: London Clay.—Towards the end of 1918 the writer was offered, through the courtesy of Dr. J. E. Stead, a small quantity of two open hearth basic slags from the same steel works but of widely different solubilities.

As a fair comparison could not be obtained by adding plots to any of the seven experimental centres then in progress it was decided to start a new experimental centre.

The phosphates applied to Plots A, 1, 2, 4, 5, 6 and 9 were drawn from the same bulk as those used in the previous experiments.

Table 4.—Weight of Hay at Butcher's Farm, Lambourne End.

Manures sown: January 19th, 1919.

Plots ¼ acre	Manure 200 lb. P_2O_5 per acre	Citric solubility of the phosphate, per cent.	Hay (in cwt. per acre)			
			1919	1920	1921	Average 3 years
A	Cambridge coprolites ...	25	25·0	32·3	3 33	30·2
1	Open hearth (fluorspar) basic slag	29	26·6	34·7	38·5	33·3
2	Open hearth basic slag ...	91	24·5	36·2	31·0	30·6
3	No manure	—	13.2	21·4	18·4	17·7
4	Egyptian phosphate ...		18·0	34·4	27·4	26·6
5	Florida pebble phosphate ...	18	16·9	37·8	30·5	28·4
6	Tunisian phosphate ...		19·0	38·1	34·0	30·3
7*	Open hearth (fluorspar) basic slag (Wigan) ...	32	16·0	34·1	29·4	26·5
8*	Open hearth basic slag (Wigan)	80	23·7	38·0	28·5	30·1
9	Cleveland phosphate ...	19	19·9	38·9	34·4	31·1
	Rainfall, May 1st till harvest (in inches)	—	3·08	5·27	2·44	
	Date of cutting	—	July 17	July 17		

* Plots 7 and 8 = $\frac{1}{10{\cdot}2}$ of an acre.

At Butcher's Farm the soil down to a depth of about 12 in. was of a fibrous peaty character, and, although it rested on a stiff London clay subsoil, the first 9 in. of soil resembled a sour peat loam. Scarcely a trace of leguminous plants has been visible on the untreated plot throughout, the hay consisting largely of water grasses and the type of weeds characteristic of sour soils. The soil had a high lime requirement (0.45 per cent.).

At this centre there have been no indications that high citric solubility is of any particular advantage. The open hearth fluorspar slag (Plot 1) which did so poorly at Martins Hearne and Horndon (Tables 2 and 3) gave quite as good results as the high soluble slag. The open hearth fluorspar slag used on Plot 7, in spite of the fact that it is more soluble than the one used on Plot 1, did not do so well.

The three rock phosphates have proved quite satisfactory. Florida Pebble which gave comparatively poor results at Horndon did much better on the sour soil at Butcher's Farm. The results at this centre suggest that on sour pastures and meadows there is little advantage to be gained from high citric solubility.

Field Experiments on Arable Land in Northern Ireland.—The Essex Experiments deal entirely with grass land, the conditions being materially different from those under arable conditions. In the former case the growing season is long, the manures can be conveniently applied in the autumn, and rapidity of action is not of such importance as on arable land.

In conjunction with Mr. D. R. Aiken, Mr. James Bradshaw, Mr. H. S. Cuthbertson, and Mr. P. T. O'Hare, County Agricultural Instructors for Londonderry, Armagh, Down, and Antrim respectively, a series of rotation experiments was begun in Northern Ireland in the spring of 1921 with the object of obtaining information as to the value of Gafsa phosphate under arable conditions. The manures were applied to the turnip crop in the drill in April.

TABLE 5.—ROTATION EXPERIMENTS WITH VARIOUS PHOSPHATES.

—	ANTRIM.				ARMAGH.		DOWN.				LONDONDERRY.	
	No farmyard manure.				With farmyard manure.		With farmyard manure.				With farmyard manure.	
	Cloughmills.		Ballynure.		Bessbrook.		Ballywalter.		Crossgar.		Drumaduff.	
	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.
No phosphates ...	4	14	only 3 turnips		30	5	24	6	14	4	25	13
Superphosphate ...	18	0	35	12	34	7	25	10	25	7	28	8
Gafsa phosphate ...	16	10	39	3	32	0	27	6	27	18	28	0
Basic Bessemer slag	18	15	38	6	—		—		—		—	
Open hearth high sol. slag... ...	16	15	38	12	3		26	8	28	3	28	4
Steamed bone flour	19	10	—		—		25	10	25	14	29	1

In the Antrim Experiments no farmyard manure was applied, but in its place each plot received 1½ cwt. sulphate of ammonia and 1½ cwt. muriate of potash per acre. The dressing of phosphate was equivalent to 200 lb. of phosphoric acid per acre (approximately 10 cwt. of 40 per cent. slag).

In Counties Armagh, Down and Londonderry the plots received a dressing of 15 tons per acre of farmyard manure. With the exception of the various phosphates no other artificials were applied. At these centres the phosphates were applied at half the previous rate, *i.e.*, at the rate of 100 lb. of phosphoric acid per acre, approximately equivalent to 5 cwt. of 40 per cent. slag per acre.

At Bessbrook, Ballywater, and Drumaduff the response to phosphates after the application of farmyard manure was so small as to make the results of no value as a measure of the relative efficiency of the various phosphates.

At Cloughmills, Ballynure, and Crossgar there has been a striking response to phosphates. The soil at Cloughmills is a medium loam, at Ballynure a light loam and at Crossgar a light sand. At Cloughmills superphosphate and basic Bessemer slag had a slight advantage over the Gafsa phosphate. At Ballynure the Gafsa phosphate gave slightly the better result. At this centre the basic phosphates have done uniformly better than superphosphates. The failure of the crop in the absence of phosphates is striking. The farmer, Mr. W. McC. Barklie, J.P., emphatically stated at the commencement of the experiment that we would not get a crop on the "no phosphate plot." The turnip plants brairded satisfactorily, but with the exception of three plants they failed to make any further growth.

On the light sandy soil at Crossgar a very satisfactory response of from 11 to 14 tons per acre followed the addition of phosphates to dung. At this centre also there was no practical difference between the return from Gafsa phosphate and from high soluble slag. There is evidence that under the conditions at Crossgar they are both to be preferred to superphosphate.

The Irish experiments are only in the preliminary stages and it is not the purpose of the writer to draw definite conclusions from them. They do, however, show that the results obtained with rock phosphates on grass land in Essex are applicable to certain arable soil conditions. In continuance of this work a further series of rotation experiments with rock phosphates and two big grazing trials were laid down in the spring of this year by the Ministry of Agriculture for Northern Ireland.

Conclusions from the Field Experiments.—1. *Open Hearth Fluorspar Basic Slags.*—On the whole the results must be taken as showing that these slags are not as effective as the high soluble types. They have, however, a considerable value, and are not so bad as the solubility figures would suggest. Where the rainfall is high and the soil sour their effectiveness may closely approximate to that of the more soluble types. Where the soil is not decidedly sour and where the rainfall is low their inferiority is more clearly marked. For the manuring of grass land the writer is of opinion that if the value of the high

soluble slags is taken as 100 then the fluorspar basic slags have a value of from 50 to 70.

2. *Rock Phosphates.*—The results of all the experiments agree in showing that rock phosphates have a much higher manurial value than has hitherto been admitted. On sour soils and where the rainfall is high there is a certain amount of evidence which suggests that they may even prove superior to the best grades of basic slag. Even under conditions which favour high solubility (low rainfall and a sweet soil), as at Horndon, their value as a source of phosphate for the manuring of grass land is very close to that of high soluble basic slag. In every experiment they have proved more effective than the open hearth fluorspar slags.

Of the various types of rock phosphate Gafsa seems to be the most suitable for direct application. There is evidence that on sweet soil, or where the rainfall is low, the more soluble types of North African phosphates, *e.g.*, Gafsa, Egyptian, Algerian, and Tunisian, are superior to the richer, less soluble and harder types such as Florida Pebble.

* * * * * *

BASIC SLAG:

SECOND INTERIM REPORT OF THE PERMANENT COMMITTEE.*

The Permanent Committee recently presented to the Minister the following second interim report on their experiments and deliberations during 1921 :—

The reference given us was to consider the development and improvement of the manufacture of basic slag and the extension of its use. In considering these questions we have been compelled to give some attention to other phosphatic manures (viz., raw phosphates) both from the point of view of their being mixed with basic slag so as to supplement supplies of the latter, and also of ascertaining how various grades of basic slag compare with raw phosphates in agricultural value.

The basal facts in the situation are as follows :—

1. **Demand for Basic Slag.**—The demand for ground basic slag by the farmers of the United Kingdom has increased since the pre-war period (1912) from 290,000 tons to some 400,000 to 500,000 tons (with phosphate content of 11,000,000 to 12,500,000 units) per annum, and in the view of competent agricultural

* An abstract of the First Interim Report appeared in the September, 1921, issue of the *Journal*, p. 521.

experts it ought still further to increase. The figures are as follows, in tons per annum:—

	Pre-War Consumption. (1913.)	*Deliveries† (Year ending May 31st) 1919.*	*1920.*	*1921.**	*Expert estimate of quantity that could be consumed. Sir T. H. Middleton.*	*Sir A. D. Hall.*
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
England and Wales ...	—	433,000	407,000	328,000	890,000	975,000
U. Kingdom	290,000	539,000	503,000	400,000	(33,820,000 units.)	(37,050,000 units.)

The 1921 figures show a depression which is readily explained and will, we hope, prove temporary only.

2. **Production of Basic Slag.**—On the other hand the production of unground basic slag has not correspondingly increased. Prior to the war it was about 400,000 tons; it rose in 1919-20 to some 701,000 tons, but in 1920-21 was less than 400,000 tons,* and in 1920 and 1921 was substantially less than the farmers' demands. Moreover, there has been a reduction in quality; in consequence of the supersession of the Bessemer process by the Open Hearth process the slag now obtainable contains on an average only half the percentage of phosphate of pre-war days, and much of it shows reduced solubility according to the official tests.

3. **Imported Basic Slag.**—The demands of the farmer have been met to some extent by importation from abroad. Thus, while in 1913 the balance of exports over imports was 114,000 tons, in 1920 and 1921 the balance of imports over exports was 6,000 tons and 38,000 tons respectively (a certain proportion of which was unground). Export has, however, in these years been prohibited except by licence.

In view of the likelihood that the quality of basic slag manufactured on the Continent may decrease as it has in the United Kingdom following upon a similar change in process of manufacture, and further that the demands of farmers abroad may increase, it would be unwise for farmers in this country to rely to any serious extent on importation.

The chief results of our deliberations during the year are set out below.

4. **Possibilities of Increased or Improved Production.**—After careful investigation we are being reluctantly forced to the conclusion that little, if any, change in blast furnace or steel furnace

* Much affected by the coal stoppage and the slackness of the steel trade.

† The actual consumption of basic slag has recently been slightly greater than the figures of deliveries shown, owing to the fact there has been an excess of imports over exports.

procedure is likely to be made with the purpose of improving either the output or the quality of slag. We are compelled to recognise that from the steel makers' point of view basic slag is relatively unimportant. On the average rather less than 4 cwt. are obtained for each ton of basic steel produced, and while a ton of steel has been worth from £27 in 1920 to £10 in 1921, the 4 cwt. of slag are worth not more than 2s. to the steel makers (and only about 6s. at makers' works even after the slag grinder had graded, ground and bagged the slag). The steel maker cannot afford to alter his processes in any way that would lengthen them or make them more costly or hazardous. The practical result is that the composition of basic slag is determined by the conditions under which the steel maker is working, and the total amount producible is regulated by the demand for steel; neither of which factors is in any way within the control of the agriculturist or influenced to any appreciable extent by his demands.

Various possibilities, such as the reintroduction of low grade slags into the blast furnace, the use of ores containing more phosphorous, etc., have been examined. Some of these methods are in partial use, where local conditions favour them, but any wider application is ruled out by the increased consumption of fuel which is usually necessary, and which is frequently accompanied by decreased output of the blast furnaces and in consequence increased cost of the pig iron.

5. **Remedies for Shortage.**—Having established the facts that the output of slag is less, and likely to remain less, than could advantageously be used by farmers, and that we can neither expect any increase in quantity of slag apart from increased output of steel, nor look to the steel makers to improve its quality, we are investigating the possibility of increasing the effectiveness of basic slag and the possibility of finding effective substitutes in ground mineral phosphates.

(*a*) *Effectiveness of Slag.*—One of the slags tested in the field in 1921 gave considerably better results than could have been anticipated from its chemical composition. We are going closely into this matter to see if any improvement in effectiveness is possible.

(*b*) *Substitution of Mineral Phosphates.*—The preliminary survey of last year has shown that the use of ground mineral phosphates would afford a ready means of solving this difficult problem. We have begun a careful inquiry into the fertiliser value of these phosphates.

(i) We have included a typical North African mineral phosphate in our trials at Rothamsted, and have arranged for a trial with Nauru phosphate.

(ii) We are keeping in close touch with, and are repeating side by side with our own experiments at Rothamsted, the experiments on mineral phosphates and basic slag now being carried out in various counties by the agricultural organisers under the ægis of the Agricultural Education Association, and this is facilitated by the circumstance that the Chairman of your Committee is also Chairman of the Experiments Committee of the Association.

6. **Field Trials.**—Owing to the exceptionally severe drought of 1921 very few results were obtained in any of the field trials, and in any case the trials must extend over several seasons before we can put forward definite conclusions.

So far as our present information goes:—

(*a*) The high soluble open hearth basic slags have the same agricultural value per unit of phosphoric acid as the old Bessemer slags.

(*b*) The low soluble slags have a smaller value, but in some circumstances the difference is not markedly great. There is, however, considerable diversity in effectiveness, and we have reason to believe that this group includes materials of very different natures, though the citric solubility test fails satisfactorily to distinguish between them.

(*c*) The mineral phosphates also have a smaller value, but again in some circumstances not as much less as might have been expected.

It is hoped that as a result of these trials we may ultimately be able:—

(1) To map out the country into regions where the high soluble slag can, and where it cannot, effectively, be replaced by low soluble slags and mineral phosphates;

(2) To advise the Ministry whether the annual output of some 70,000 to 140,000 tons of very low grade slag (under 15 per cent. phosphate) at present not recommended for use by the farmer, could with advantage be used after being admixed in any way with mineral phosphates.

7. **Solubility Test.**—Our experience with slags of different solubilities leads us to conclude that the official solubility test needs revision.

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LIVE STOCK AND HORSE BREEDING IMPROVEMENT IN ENGLAND AND WALES.

Report for the Year 1921-22.

Live Stock Scheme.—The aims and objects of the Live Stock and Horse Breeding Improvement Schemes of the Ministry of Agriculture and Fisheries, and the steps taken to secure them, were so fully described in the recently issued Report of Sir Daniel Hall on the work of the Intelligence Department of the Ministry for the two-year period ending 31st March, 1921, that it is not necessary to explain again the reasons for the Schemes or the lines on which they are conducted. Those interested in the Schemes and horse and stock breeders generally may, however, wish to know the results for the year ending 31st March, 1922, and to compare them with those of previous years.

The Live Stock Scheme has now been in operation for eight years, and a review of what it has accomplished in face of serious difficulties, to which full reference has been made in previous reports, amply justifies its inception and vindicates its continuation, notwithstanding the call for economy in every branch of national expenditure. The new importance given by the War to the live stock industry as a source of food supply, and the imperative necessity for improvement in the methods that have satisfied the non-pedigree breeder for so long, are beginning to be realised by the farming community. To meet this need the Ministry's scheme has sought to demonstrate the value of a good sire and has assisted farmers by means of grants to obtain the services of such animals at reasonable fees. It has also, by giving financial assistance to societies formed for the purpose, encouraged the keeping of milk records which enable farmers to weed out unprofitable cows and thus grade-up their dairy herds. How much the scheme has progressed on these lines will be readily seen from the figures given in this report. The location of so many approved sires throughout the country must have a beneficial influence on the type of stock reared, and a satisfactory feature of the scheme is the improvement in the sires provided and the readiness of farmers to pay higher service fees.

The Committee on National Expenditure—commonly known as the Geddes Committee—recommended very considerable reductions in the expenditure on the Live Stock Schemes, but after full consideration the Government decided that no "cut" need be made in the subsidy to Milk Recording, Bull and Boar Societies. In view, however, of the urgent necessity for reduction in public expenditure the Ministry had reluctantly to discontinue its grants this season to Heavy Horse Societies, but as the majority of the societies subsidised were not in an unsatisfactory financial condition and had learnt the value of using good sires and of co-operating to secure the provision of them, it is hoped that the societies will continue their good work even though financial assistance from the Ministry is no longer possible. In this connection it may be pointed out that the Heavy Horse Scheme was initiated in 1914 with the object, *inter alia*, of discouraging the use of the unsound travelling stallion whose popularity was mainly due to his low fee. As, however, the unsound travelling stallion has been driven off the road by the operation of the Horsebreeding Act, 1918, it will be recognised that the need for the Heavy Horse Scheme is not so great now as it was when originally brought into operation. Its discontinuance is nevertheless regretted.

The progress made by the Boar, Bull and Milk Recording Schemes is satisfactory, and the following details may be of interest :—

Year.	Boars.			Bulls.			Horses.	
	No. of		Total Animals	No. of		Total Animals		
	Societies.	Individuals.	Boars	Societies.	Individuals.	Bulls.	Societies.	Stallions.
1914—15*	115	nil	115	369	43	497	65	72
1915—16	180	nil	193	489	28	633	88†	97
1916—17	186	15	216	543	15	659	93†	108
1917—18	172	92	264	578	14	710	94†	110
1918—19	156	167	350	604	7	721	101†	122
1919—20	120	225	399	568	6	675	93†	118
1920—21	135	285	441	561	6	668	86†	105
1921—22	113	416	550	726	3	847	83†	101

* Including the period 1st February, 1914—31st March, 1914.

† Excluding the Cumberland and Westmorland Heavy Horse Society formed in 1915—16, which issues assisted nominations only.

Milk Recording.

Year.*		Societies.	Members.	Herds.	Cows.
1st April to 31st March	1914-15	16	264	306	7,331
	1915-16	20	350	398	9,811
	1916-17	22	441	495	12,950
	1917-18	25	503	555	14,404
1st October to 1st October	1917-18	27	639	708	19,793
	1918-19	38	1,191	1,332	37,880
	1919-20	46	2,075	2,312	61,323
	1920-21	52	3,328	3,664	97,903

* Prior to 1st October, 1917, there was no uniform year for Societies.

Boars.—Further substantial progress has been made by the Boar Scheme during the year ended 31st March, 1922. There has been a slight fall in the average price paid for all breeds except Berkshire and Essex, in which cases there was a marked increase, but the numbers of boars of these breeds are small. The service fees again show an upward tendency and, as illustrating the sow owners' willingness to pay more for a good sire, the point is worthy of notice. Another interesting feature of the following table is the inclusion of four breeds that were not represented in the early years of the Scheme. It has been pointed out in previous reports that the Live Stock Scheme has had the direct result of the establishment of new herd books, and in this connection the Gloucester Old Spots and the Cumberland breeds appear to be growing in popularity. A Gloucester Old Spots Boar provided during the year had an estimated value of

Number and Average Prices of Boars.

Breed.	1914-15		1920-21		1921-22	
	No.	Price.	No.	Price.	No.	Price.
		£ s. d.		£ s. d.		£ s. d.
Berkshire	10	8 0 0	5	18 15 10	11	23 19 10
Cumberland	—	—	28	19 9 7	32	17 11 10
Essex	—	—	2	30 0 0	7	33 11 5
Glos. Old Spots	7	7 0 0	51	23 12 7	51	21 4 4
Lincoln Curly Coat	4	8 0 0	17	14 14 0	24	13 0 4
Large Black	18	7 0 0	129	18 8 0	157	17 3 6
Large White	64	7 0 0	147	18 11 0	167	17 5 1
Middle White	12	7 0 0	35	20 13 0	62	19 4 3
Tamworth	—	—	2	19 0 0	1	17 0 0
Wessex Saddleback	—	—	7	34 15 4	11	22 16 11
Other Breeds	—	—	1	15 0 0	—	—
All Breeds	115	7 0 0	424	19 9 5	523	18 3 0

Service Fees.

Year.	2/-	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	6/6	7/-	7/6	8/-	8/6	10/-	Over 10/-
1914—15 ...	21	62	10	5	6	—	2	—	—	—	—	—	—	—	—	—
1920—21 ...	3	19	17	23	38	6	194	—	34	3	4	52	2	—	15	9
1921—22 ...	1	10	13	13	36	6	245	1	42	5	7	111	3	3	22	10

£100, which with an Essex boar which cost a like amount represents the highest figure for the year. As many as 161 boars cost as much as £20 or over.

Subsidised boars and their progeny have again scored many successes at shows.

Bulls.—After the successive decreases recorded in the number of bulls provided during the years 1919-20 and 1920-21 it is satisfactory to note that there was a very marked increase in the number available during the year ended 31st March, 1922. There was, as in the case of boars, a general decrease in the average prices paid for the various breeds, and a general rise in the number of service fees of 5s. and over. The highest price paid for a bull provided under the Scheme was £483 for a

Number and Average Prices of Bulls.

Breed.	1914—15.				1920—21.				1921—22.			
	No.	Price.			No.	Price.			No.	Price.		
		£	s.	d.		£	s.	d.		£	s.	d.
British Friesian	1	37	0	0	1	126	0	0	7	78	18	7
Devon	16	41	0	0	53	68	12	2	70	64	9	2
Guernsey	—	—			3	65	0	0	6	54	4	2
Hereford	63	33	0	0	66	70	5	2	78	68	15	2
Linc. Red	33	32	0	0	69	75	19	10	89	73	1	8
Shorthorn...	337	38	0	0	403	79	9	11	492	76	5	10
Red Poll	—	—			—	—			1	78	15	0
South Devon	6	37	0	0	15	76	15	4	20	69	5	2
Welsh Black	35	29	0	0	48	58	18	0	60	57	2	7
Other Breeds	6	28	0	0	1	68	5	0	—	—		
All Breeds	497	36	0	0	659	75	15	1	823	72	10	5

Service Fees.

Year.	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	6/6	7/-	7/6	8/-	8/6	9/-	9/6	10/-	Over 10/-
1914—15 ...	265	57	41	42	3	88	—	—	—	—	1	—	—	—	—	—	—
1920—21 ...	62	43	37	81	5	269	2	33	2	2	84	2	—	—	—	28	8
1921—22 ...	46	38	26	74	7	346	1	48	3	6	160	6	4	2	—	51	6

Shorthorn, while as many as 97 cost £100 or over. The fact that these high prices are paid willingly is evidence that the objects of the Scheme are being more understood and appreciated. Premium bulls and their offspring have done exceedingly well at shows. Indeed, it was almost invariably the case that where subsidised sires appeared at shows they figured largely in the award list. The following instance may be noted as typical of many. At the Danby Agricultural Society's Show on 18th August, 1921, there was a large show of premium bulls from the district and practically all the prizes were carried off by bulls in respect of which grants had been made by the Ministry. In one class for which a special prize was given for scheme bulls there were 9 entries, and the Live Stock Officer was personally complimented by the judges on the good quality of the exhibits.

Heavy Horses.—In view of the decision that grants to Heavy Horse Societies are to be discontinued it is of interest to review briefly the operations of this section of the Live Stock Scheme since its commencement. The following table shows that there was a general increase in the number of stallions provided, and mares served up to and including the 1918 service season, and a gradual decline since that year. This decline is due mainly to the fact that many societies have prospered sufficiently well to enable them to carry on without further

Year.	No. of Stallions	* Total No. of Mares served.	*Average No. of Mares served.	* No. of assisted nominations.	Average hiring fee of Stallions.	Average Service Fee.
					£	£ s. d.
1914-15 ...	72	6,365	68	1,503	231	2 8 6
1915-16 ...	97	9,122	94	2,430	241	2 9 6
1916-17 ...	108	9,995	92	2,181	244	2 11 0
1917-18 ...	110	10,556	96	2,151	258	2 16 3
1918-19 ...	122	12,281	100	2,165	285	2 15 8
1919-20 ...	118	10,920	96	1,996	317	3 6 3
1920-21 ...	105	9,133	87	1,839	345	3 13 1
1921-22 ...	101	7,888	78	1,943	333	3 13 7

* Excluding the Cumberland and Westmorland Heavy Horse Society, which was formed in 1916 for the purpose of issuing only assisted nominations to selected stallions. The figures for this Society were as follows :—

Year.	No. of Assisted Nominations.	Year.	No. of Assisted Nominations.
1915-16	385	1919-20	264
1916-17	394	1920-21	254
1917-18	328	1921-22	255
1918-19	321		

The decline in the number of assisted nominations issued by this Society is due to the increased service fees which automatically increased the value of an assisted nomination and consequently reduced the number available from the Ministry's grant.

financial assistance from the Ministry. Fully eighty per cent. of the societies subsidised by the Ministry were formed for the purpose of the Scheme, and in the year under review only 14 out of the 83 societies which received a grant under the Scheme were in existence prior to its commencement. Most of the societies are in a satisfactory financial position, and it is hoped that they will carry on without the Ministry's grant.

Sheep.—The limited financial assistance given by the Ministry in 1919-20 and 1920-21 to a scheme for the improvement of Welsh Mountain sheep was continued during 1921-22. Grants at the rate of 3s. 4d. per ewe served, up to a maximum of £10, were made to eleven societies in respect of 13 approved rams. 791 ewes were served, being an average of 61 per ram. The ram, ewes and the progeny are required by the Regulations to be earmarked. The average hiring fee of the rams was £10 6s. 2d. and the average service fee was 1s. 7d.

This scheme is very popular in the districts for which it was provided, and it is hoped to extend it as and when opportunity offers.

Milk Recording.—Notwithstanding any fears that may have existed as to the effect of the upward tendency of the cost of recording and particularly as regards the institution of a charge for certificates and the sudden drop in the price which the producer obtains for his milk, the Milk Recording Section of the Scheme has continued its progress. Six societies and 37,000 cows were added during the recording year 1st October, 1920—1st October, 1921. The movement has penetrated into practically every county in England, and in Wales where milk recording has more recently been taken up, there are only 4 counties not yet provided for.

The annual returns furnished by the 52 Societies for the recording year under review show that of the 97,903 cows and heifers recorded, 49 per cent. were animals which had been retained in the herds for the full year, and the average yield of these full-year cows was 6,562·95 lb.—a slight advance on the average for the previous year when the full-year cows, which represented 44 per cent. of the cows and heifers recorded, gave an average of 6,527·3 lb. The large influx of previously unrecorded cows at the commencement of the year has again tended to keep the average of full-year cows lower than may reasonably be expected in due course, but the averages shown in the following statement compare very favourably with the general average of all cows in milk throughout the country.

which, according to the finding of the Departmental Committee on the Production and Distribution of Milk was estimated at 436 gallons for the year 1918 :—

Comparison of Average Annual Yield for Societies for the last four milk-recording years.

Year, 1st Oct.— 1st Oct.	No. of Societies.	Particulars of all Cows and Heifers recorded.			Particulars of Cows recorded for full year.		
		No. of Cows and Heifers.	Total Yield (in gal.)	Average Yield (in gal.)	No. of Cows.	Total Yield (in gal.).	Average Yield (in gal.).
1917-18	27	19,793	8,426,958	426	8,755	5,255,924	599
1918-19	38	37,880	16,204,941	450	17,989	10,543,516	579
1919-20	46	61,323	29,344,887	479	27,266	17,363,347	637
1920-21	52	97,903	48,512,380	495	48,248	30,892,620	640

As an illustration of the progress that has been made by individual societies the following particulars of the largest Society (Essex) under the Scheme are of considerable interest :—

Year.	Particulars of all Cows and Heifers.			Particulars of Cows recorded for full year.		
	No. of Cows and Heifers.	Yield (in gal.).	Average Yield (in gal.).	No. of Cows.	Yield (in gal.).	Average Yield (in gal.).
1917-18	640	342,260	534	407	259,331	637
1918-19 ...	3,529	1,811,075	513	2,141	1,314,709	614
1919-20	4,412	2,299,612	521	2,226	1,516,153	681
1920-21	6,427	3,566,124	555	3,543	2,500,971	708

The following example of the great difference which exists between herds in their milk producing value is of interest. Two members of the same society had 42 cows each. All were recorded for the full year. The average yield of the 42 cows in one herd was 9,117 lb. and of the other 3,812 lb. The approximate difference in the total yield was 21,733 gallons, which at 1s. per gallon represents a difference of £1,086 for the same number of cows.

The charge which was placed on milk record certificates in accordance with the recommendation of Sir Beville Stanier's Committee resulted as was expected in a great decrease in applications for certificates: 4,374 certificates were issued as compared with 16,425 in the preceding year. The decrease is considerable, but the falling off of about 3,500 applications in respect of yields of less than 6,000 lb. affords little ground for regret.

The following Table shows the classification of yields of cows which have been certified by the Ministry for each recording year, since 1st October, 1917 :—

Year.	No. of Certificates issued.	1 to 1,000 lb.	1,001 to 2,000 lb.	2,001 to 3,000 lb.	3,001 to 4,000 lb.	4,001 to 5,000 lb.	5,001 to 6,000 lb.	6,001 to 7,000 lb.
1917-18	4,178	1	3	18	47	186	522	1,099
1918-19	7,373	5	6	32	121	371	1,353	2,111
1919-20	16,425	—	19	70	224	657	3,015	4,069
1920-21	4,374	11	12	21	35	89	356	686

Year.	No of Certificates issued.	7,001 to 8,000 lb.	8,001 to 9,000 lb.	9,001 to 10,000 lb.	10,001 to 11,000 lb.	11,001 to 12,000 lb.	12,001 to 13,000 lb.	13,001 to 14,000 lb.
1917-18	4,178	1,031	723	324	131	59	20	8
1918-19	7,373	1,565	1,044	464	173	73	33	14
1919-20	16,425	3,491	2,514	1,254	648	252	96	46
1920-21	4,374	806	1,084	613	339	169	67	38

Year.	No. of Certificates issued.	14,001 to 15,000 lb.	15,001 to 16,000 lb.	16,001 to 17,000 lb.	17,001 to 18,000 lb.	18,001 to 19,000 lb.	19,001 to 20,000 lb.	20,001 to 21,000 lb.
1917-18	4,178	4	2	—	—	—	—	—
1918-19	7,373	4	—	1	2	—	1	—
1919-20	16,425	19	9	8	2	2	—	2
1920-21	4,374	14	13	6	6	6	2	1

The fifth volume of the Ministry's Annual Register of Dairy Cows with authenticated milk records for the year ended 1st October, 1921, contains particulars of 2,441 cows (belonging to 493 members) in respect of which certificates have been issued by the Ministry showing that they have yielded 8,000 lb. or more during the year, or an average of 6,500 lb. or more during that year and one or more preceding consecutive years. Thirteen recognised breeds or types are represented in the Fifth Volume, and there are in addition 142 cross-bred cows whose milk yields have reached the prescribed standard.

Of the 2,441 cows entered 2,028 gave over 8,000 lb. of milk during the year, and 413 were entered on an average of 6,500 lb. or over. Of the 2,028 cows which were entered on the one year's yield, 931 gave between 8,000 and 9,000 lb.; 521 between 9,000 and 10,000 lb.; 290 between 10,000 and

11,000 lb.; 147 between 11,000 and 12,000 lb.; 58 between 12,000 and 13,000 lb.; 37 between 13,000 and 14,000 lb.; 14 between 14,000 and 15,000 lb.; 13 between 15,000 and 16,000 lb.; 3 between 16,000 and 17,000 lb.; 6 between 17,000 and 18,000 lb.; 5 between 18,000 and 19,000 lb.; 2 between 19,000 and 20,000 lb. and 1 over 20,000 lb.

The Calf Marking Scheme, which is an essential factor in the grading up of recorded cows, has now been taken up by 52 of the 55 Milk Recording Societies.

An examination of the financial statements furnished by societies again revealed an increase in the average cost per cow both to the society and to the member.

It is probably an indication of the commercial value of milk recording that this tendency toward increasing cost has not constituted a serious deterrent to the extension of the practice. This value has been frequently demonstrated by the prices realised at sales for recorded non-pedigree cows. The following are the results of a few of the sales of non-pedigree cattle reported to the Ministry, and in view of the drop in the value of stock the prices obtained may be considered satisfactory.

At the Lancashire County Milk Recording Society's second annual Spring Show and Sale at Preston on 17th March, 1921, 45 non-pedigree Shorthorn cows realised an average price of 58 guineas, the highest prices being 100 (twice) and 90 guineas.

At the Sale on 23rd March, 1921, of the herd of a member of the Berkshire Milk Recording Society, 39 non-pedigree Shorthorn cows and heifers realised an average of 58 guineas, one cow fetching 155 guineas.

Fifty-five non-pedigree cows and heifers realised an average of 60 guineas at the sale of a herd recorded by the Oxfordshire Milk Recording Society on 31st March, 1921. The highest prices were 120, 101 and 90 guineas.

At a Sale on 4th October, 1921, of a recorded herd owned by a member of the North West Wilts Milk Recording Society the average price obtained for 99 non-pedigree cows and heifers was 59 guineas. The highest prices for cows and heifers were 220, 105 (three times) and 100 (three times) guineas, and for calves 100, 45 and 38 guineas.

Forty non-pedigree Shorthorn cows and heifers averaged 69 guineas at the Sale on 7th October, 1921, of a herd recorded by a member of the Hampshire Society. The highest prices were 120, 110, 100 (twice) guineas.

At the Lancashire Milk Recording Society's fourth Annual Show and Sale on 10th November, 1921, 61 non-pedigree cows and heifers averaged 63 guineas. The highest prices were 100 (twice), 98, 93 and 90 (three times) guineas, and for the calves 49 and 42 guineas.

At a Sale of recorded non-pedigree cattle at Penrith on 11th November, 1921, 3 cows made 117, 95 and 94 guineas respectively.

On the 15th November, 1921, the herd of a member of the Kent Society was disposed of. Fifty-eight non-pedigree cows and heifers realised an average of 78 guineas, the highest prices being 120, 110 (twice), 108, 105, 102, 100 (four times) guineas. For calves the highest prices were 30 and 25 guineas.

The following are the principal memoranda used in connection with the livestock operations of the Ministry, and copies of them can be obtained free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, Whitehall Place, London, S.W.1.

Leaflet 282	...	Scheme for the Improvement of Live Stock.
Leaflet 146	...	The Value of Records of the Milk Yields of Cows.
No. 609/T.L. (L2)	.	Bull Grant Regulations.
No. 392/T.L. (L4)	.	Milk-Recording Regulations.
No. 446/T.L. (L11)	.	Boar Grant Regulations.

Particulars of the Light Horse Breeding Scheme for the year ended 31st March, 1922, will be published in the October issue of the *Journal*.

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GRADING AND SIZING OF APPLES.

J. STODDART,

Ministry of Agriculture and Fisheries.

IN an article by Mr. J. Turnbull, published in the August issue of the *Journal*, mention was made of an improved type of hand-sizer which was being tested by officers of the Ministry. The writer is now able to describe and illustrate this apparatus and explain the considerations which brought about its production.

One of the greatest difficulties encountered in securing the adoption and use of the standard box for English apples has been the lack of a simple, efficient and speedy means of grading and sizing the fruit. Experience at many demonstrations of box packing indicates that the majority of growers desire some sort of apparatus which will separate the apples into definite sizes without the apprenticeship needed for eye-sizing, and that they prefer to fill and close one box at a time.

While weight-sizing is undoubtedly the most efficient method, machines for this purpose are necessarily costly and methods of sizing by diameter must be considered. In anticipation of

possible criticism of this method it is pointed out that, as few apples are truly circular on any section and in many varieties the length varies considerably in proportion to the transverse diameter, it is obvious that sizing by any one diameter cannot be accurate. Results, however, show that this approximate sizing enables a packer, after very little practice in the final sizing by eye, to fill boxes at a reasonable speed.

After some consideration and experiment the writer has been able to design and construct a simple hand-operated sizer which marks a substantial advance on the various ring, hole and peg methods hitherto used. As will be seen in Fig. 1 it consists of two curved walls attached to a baseboard in which is cut a slot corresponding to, but extending slightly beyond, the ends of the walls. The width of this channel, moving from left to right, is reduced by steps at regular intervals according to the number of sizes decided on, in this case five. A canvas-top table with five radial compartments is used, and on it the sizing board is placed, as shown in Fig. 2, each step in the channel registering with its respective compartment.

The operator sits or stands behind the sizing board with ungraded apples in a box on his left together with boxes in which to place the very large and blemished apples rejected. Another box is placed on the right to receive the very small apples which pass clear through the sizer.

In operation, the apples are picked up singly in the left hand, examined for blemish and passed to the right hand with the stem up. The apple, held between the thumb and fingers, is passed between the walls of the channel until, on account of the diminishing width, it stops at one of the steps. When this occurs all that is necessary is to release the apple, which falls into the compartment corresponding to its size, rolling towards the outer side of the table ready for the packer. In a very short time this operation can be done *by touch alone* so that *the whole of the operator's time and attention can be devoted to the important work of inspection*. As apples must, at some time or other, be handled singly for inspection, a great deal of time is saved when the sizing is carried on concurrently with this operation.

The sizer illustrated varies $\frac{1}{4}$ in. from step to step and delivers inspected apples which vary by $\frac{1}{4}$ in. on a transverse diameter. This is sufficiently close sizing for general purposes, the final sizing, as before explained, being done when filling the boxes. Where closer preliminary sizing is required the steps are graduated by $\frac{1}{8}$ in.

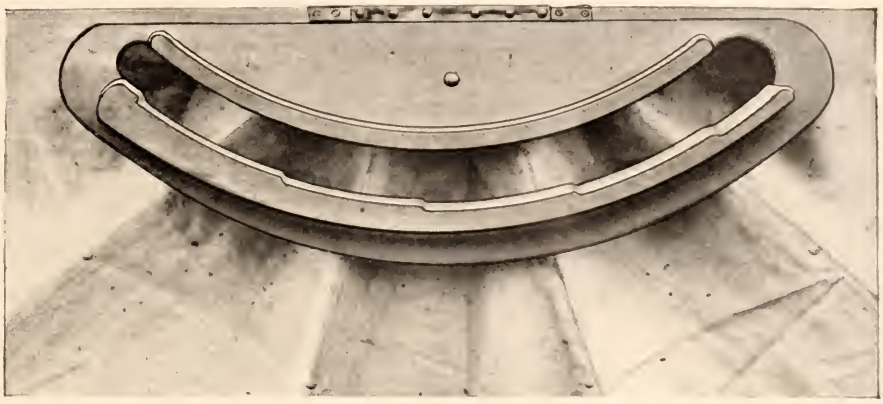

FIG. 1.—Sizing Board. Showing the two Walls attached to the Slotted Baseboard.

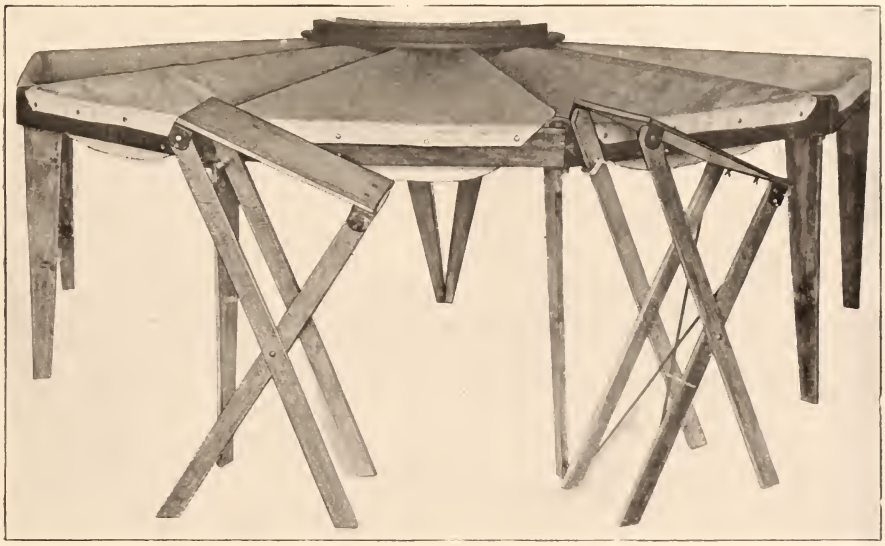

FIG. 2.—Grading Table, with canvas top, showing radial compartments and sizing board in position.

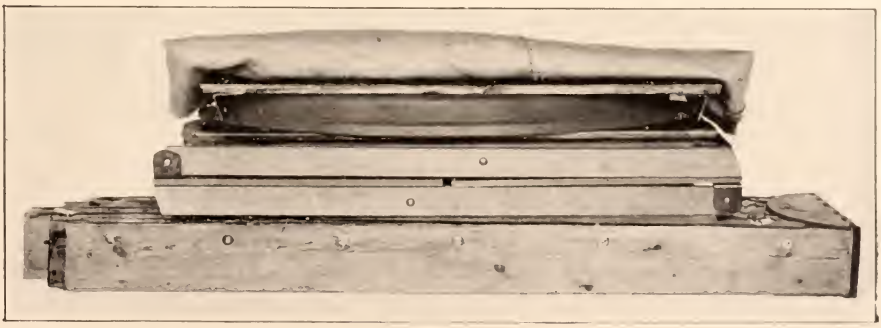

FIG. 3.—Apparatus folded for transportation, showing the small compass into which it can be packed.

Adjustment for the different sizes of varieties is easily made by placing one or more rubber bands, $\frac{1}{8}$ in. thick, on the inside of the inner wall of the channel, each band reducing the whole of the sizes by $\frac{1}{8}$ in. This arrangement is of great advantage when dealing with those varieties which are difficult to pack on regular sizes (*e.g.*, 3 in., $2\frac{3}{4}$ in., $2\frac{1}{2}$ in., etc.) as the insertion of a band produces intermediate sizes (*e.g.*, $2\frac{7}{8}$ in., $2\frac{5}{8}$ in., $2\frac{3}{8}$ in., etc.) when the difficulty usually disappears.

For the ease of transport necessary in demonstration work the apparatus illustrated has been designed to fold to a small compass (5 ft. by $1\frac{1}{2}$ ft. by 1 ft.) including the two box-stands (Fig. 3). While not really necessary for commercial work it is of advantage to a grower to be able to fold up and store away the apparatus when the season's work ends.

Anyone interested in the invention can obtain further information on application to the Ministry.

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THE ALLOTMENTS ACT, 1922.

THE provisions of the Allotments Act, which received the Royal Assent on the 4th August, 1922, not only deal with the administration of the Allotments Acts by local authorities and the provision of allotments by those bodies, but also make a number of amendments in the existing law, which will be of interest and importance to landowners and to the many thousands of allotment-holders in England and Wales.

It is not proposed in this note to deal exhaustively with the alterations in the law which directly affect local authorities and their administration. The Ministry will issue to such authorities a leaflet dealing fully with the whole of the provisions in the new Act. This note deals only with those provisions of the Act which directly affect private individuals.

It has hitherto been one of the chief grievances of allotment-holders that they were liable to be dispossessed of their plots on short notice, and although the existing legislation provided that the allotment-holders should be entitled to compensation for their crops, etc., this did not altogether meet their contention that, after putting a considerable amount of time and labour into the cultivation of their plots, they were liable to be dispossessed without being able to reap the full reward of their labours.

The basic position taken up in the new Act as regards allotment gardens (which expression is described as "an allotment not "exceeding 40 poles in extent which is wholly or mainly "cultivated by the occupier for the production of vegetables or "fruit crops for consumption by himself or his family") is that, *notwithstanding any agreement to the contrary*, the tenancy of such an allotment garden, or of land let to a local authority or association for the provision of allotment gardens, cannot in future be terminated by the landlord by notice to quit or re-entry except by a six months' or longer notice to quit expiring on or before the 6th day of April, or on or after the 29th day of September in any year. Moreover, if the tenancy of the tenant is terminated at Michaelmas (29th September) or Old Michaelmas (11th October), either by notice to quit given by the landlord, or by the termination of the tenancy of the landlord, the tenant will be entitled at any time within 21 days after the termination of the tenancy to remove any crops growing on the land.

To this general rule, however, there are some exceptions, where the circumstances are not those which ordinarily obtain. Where the land is required for building, mining, or any other industrial purpose, or for roads or sewers necessary in connection with any of these purposes, or where the land is required by the owners or lessees of a railway, dock, canal, water or other public undertaking for the purpose (not being the use of land for agriculture) for which it was acquired, or held by the corporation or company, or in the case of land let by a local authority (other than land acquired by the local authority before the 4th August, 1922, under the Housing Acts) on account of the land being required by the local authority for the purpose not being the use of land for agriculture for which it was acquired, the landlord can re-enter under a power of re-entry contained in or affecting the contract of tenancy after three months' previous notice in writing to the tenant of the allotment garden. Further exceptions are that where land is required by a statutory company or corporation of the kind mentioned above, in case of emergency, and in the case of land acquired under the Housing Acts before the 4th August, 1922, and required for the purposes of those Acts, re-entry can be made under a power in that behalf contained in or affecting the contract of tenancy after the expiry of such period of notice to the tenant of the allotment garden as is provided for in such contract of tenancy.

The above provisions of the Act do not apply to land held by or on behalf of the Admiralty, War Department or Air Council, when possession of land is required for Naval, Military, or Air Force purposes, or to tenancies of Defence of the Realm allotment gardens.

In the case of land let either *before or after* the passing of the Act for use by a tenant as an allotment garden, it is provided that the tenant will be entitled to compensation for crops and manure on the basis of the value to an ingoing tenant only if the tenancy is terminated by the landlord, and is so terminated either between the 6th day of April and the 29th day of September (the ordinary summer cropping season of an allotment garden) or by re-entry at any time in the exceptional circumstances set out above. In the case of land let *after* the passing of this Act to any local authority or association for the purpose of being sub-let for use by the tenants as allotment-gardens, the landlord will be liable to pay compensation to the local authority or association, notwithstanding that the crops have been grown and the manure applied by the tenants of the local authority or association. In future the compensation payable to a tenant of an allotment garden will be determined in default of agreement by a valuation made by a person appointed, if the parties cannot agree, by the judge of the County Court having jurisdiction in the place where the land is situated. These provisions take the place of the existing statutory provisions as to compensation for disturbance, or crops, etc.

The Act also gives a Borough or Urban District Council power to enter for the purpose of providing allotment gardens on land which is unoccupied at the date of the notice of entry, or which was unoccupied when possession was first taken by the Minister of Agriculture for the purpose of providing Defence of the Realm allotments. "Unoccupied" land means land which is not the subject of such occupation as would involve liability to the payment of the poor rate or any rate leviable in like manner as the poor rate. Any person who is interested in any land so entered upon and suffers any loss as the result of the Council's entry, can claim compensation by way of periodical payments or otherwise, the amount to be determind in default of agreement by a valuation made by a person appointed, if the parties cannot agree, by the Minister of Agriculture. The owner of any land so entered upon by a Council may terminate the Council's right of occupation by giving not less than two months' notice in writing in any case where the

land is required for any purpose other than the use of the land for agriculture.

If any question arises as to whether a landowner in good faith requires possession for a specified purpose (*e.g.* building) of land acquired or entered on by a local authority or let to an association for allotment gardens, the local authority or association may refer the question to arbitration. The landlord must state in writing the purpose for which re-entry is required, and the appeal must be made within ten days after receiving this notification. This appeal does not apply to land let by a railway, dock, canal, water or other public undertaking.

The Act also provides that the Council of every Borough or Urban District with a population of 10,000 or upwards, shall, unless exempted by the Minister of Agriculture after consultation with the Minister of Health, establish an Allotments Committee (which may be an existing Committee of the Council or a Sub-Committee of an existing Committee) to which all allotment matters except the power of raising a rate or of borrowing money shall stand referred. This Committee must comprise persons other than members of the Council representative of the interests of occupiers of allotment gardens in the borough or district, provided that the number of such representative members shall be not more than one-third of the total number of the members of the Committee or be less than two or one-fifth of such total number whichever be the larger.

Until the 31st December, 1922. Orders made for the compulsory acquisition of land for allotments will, subject to certain exceptions, not require confirmation by the Minister of Agriculture.

Unless an acquiring authority serves notice to treat under an Order within three calendar months of the making of the Order it will become null and void.

The Act also provides that, in future, allotments provided by a Council shall be let at the full fair rent for such use, but Councils are still required to act on the principle that the whole of their allotments undertaking is to be carried on upon a self-supporting basis except that acquisition expenses (such as legal costs), the cost of making public roads, and sinking fund charges in respect of loans raised in connection with the purchase of land, need not be included as expenses for the purpose of drawing up the balance sheet of their undertaking.

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THE REVIVAL OF VILLAGE INDUSTRIES:

THE OBJECTS AND WORKING OF THE COUNTRY INDUSTRIES CO-OPERATIVE SOCIETY LIMITED.

A. Bowman.

In the July issue of this Journal *there appeared an article explaining the objects and working of the Rural Industries Intelligence Bureau. The following pages give a short account of the work of the sister organisation, The Country Industries Co-operative Society, Limited.*

It was felt from the first both by the Development Commissioners and the Committee of the Rural Industries Intelligence Bureau that the formation of a co-operative trading society formed an essential part of any scheme for the assistance of the many crafts and industries scattered over the countryside. Hence the starting of the Country Industries Co-operative Society, Limited, which is registered under the Industrial and Provident Societies Acts, and is a business undertaking pure and simple. It is the wholesale trading body for all village industries and handicrafts throughout the country. The Society receives no subsidy or grants from the Government.

The members of the first Committee of Management are:—Sir Charles McLeod (Chairman), The Lady Denman, Sir Ernest J. P. Benn, Bart., Sir Basil E. Mayhew, Mr. Vaughan Nash, Mr. J. J. Dent and Mr. T. L. Coltman. This is a committee of very representative persons who give their time and services to the Society without remuneration. They are so confident of its ultimate success that they have a large financial interest in the undertaking.

The Society will work in close association with the Intelligence Bureau. The need for such a wholesale and central trading Society has long been felt, as too often the isolated, unprotected and unorganised workers have had to accept whatever price they could get for their products. This will now be remedied, as it is the intention of the Society to organise the workers in village groups, and link them up to a County Co-operative Society, so that by combination and production on an economic basis they will be able to hold their own with other trades and industries. This should not only secure them a fair reward for their labour, but also a reasonably permanent outlet, with facilities for giving

their products a standard and protection by trade marks and registered designs of the Society.

The objects of the Society are to carry on the trade of importers, manufacturers and dealers, both wholesale and retail, of or in any material and finished or unfinished articles required by workers in rural industries, and the sale or hiring of machinery, plant and equipment to workers, and the marketing of their productions, and generally to assist in the development of rural industries upon a sound economic and commercial basis. Its functions are therefore two-fold :—

(*a*) To supply raw material of every description, or half-finished goods or parts, at wholesale prices, to isolated workers or groups of workers engaged in rural industries and handicrafts; also to undertake where necessary, the hiring out of plant, and equipment such as hand-looms, sewing machines, tools, etc.

(*b*) To sell the articles and the materials made by rural workers and handicraftsmen to the best advantage in markets not always accessible to scattered workers.

Anyone wishing to purchase raw material from the trading Society will be perfectly at liberty to dispose of the finished goods elsewhere if he chooses, and if he wishes to provide his own material it will still be open to him to ask the Society to sell his goods. This should be of great value to village workers, as they will be able to obtain the raw material which they require at rock-bottom prices, and so to compete more successfully with foreign goods.

As the Society is co-operative it is not out to pay large dividends to its shareholders; the interest upon share capital is fixed by the rules and must not exceed six per cent. per annum. It will readily be seen that the Society has been established mainly to benefit its producing members. After the provision of a reserve fund, the balance of the net profits will be divided as the Annual General Meeting may determine, so that the members have full power to dispose of the profits as they think fit.

The shares are of the nominal value of £1, and are transferable. They may be paid up in full on admission to membership, or at the discretion of the Committee, by instalments. Every member must take at least one share, and no craftworker will be able to say that the shares are of such a nature that they prohibit him from joining the Society. On the other hand, no individual member can hold a share interest exceeding £200.

A further rule provides that no political or sectarian discussion shall be raised or resolution proposed at either the Committee or

General Meetings of the Society. Everybody will welcome such a rule, as it should enable persons of all political opinions to join together for the common welfare and prosperity of rural districts.

The Society has purchased the lease of excellent premises having large showrooms and warehouse accommodation situated at 258 to 262, Westminster Bridge Road, London, S.E.1. It is a corner building exactly opposite the New County Hall of the London County Council. In the various departments there will be on show samples of materials and parts required by all craftworkers. There will also be an extensive and permanent exhibition of all goods produced for which a sale is wanted.

Organisation.—In collaboration with the Rural Industries Intelligence Bureau the Trading Society aims at stimulating rural industries which can be carried on economically and profitably for the workers, and in the circumstances no industry will be recommended to any group of workers that cannot be carried on upon a commercial basis. The services of the Country Industries Co-operative Society, Ltd., would be available to :—

(*a*) All groups engaged in rural industries.

(*b*) Disabled ex-Service men's industrial settlements, centres, etc.

(*c*) Women's Institutes and Village Clubs.

(*d*) Existing home arts and industries associations.

(*e*) Independent rural industrial workers.

(*f*) Firms who are engaged in rural industries which it is the policy of the Society to encourage.

(*g*) Allied industries and craftworkers in the towns who make mechanical parts required for special rural industries.

(*h*) Landowners and farmers who produce raw material for special industries, such as osiers for basket-making.

The formation of County or local industries co-operative societies will form a necessary part in completing the scheme. Assistance will be given to those who want to form a county society, and the Secretary will be pleased to attend a meeting of the local committee in order to explain how a society is formed and worked. Model rules for the adoption of these societies have already been prepared.

In some instances, the production of a local industry is intended wholly for local requirements. An example of this is to be found in certain classes of basket-making, where both the raw materials and the market are found within a limited area. In such cases the County or local industries co-operative society

would be in a position to fulfil the functions of a trading agency, and after the local demand has been satisfied, the surplus could be disposed of through the Country Industries Co-operative Society Ltd., to which the local society will be affiliated.

Benefit to Agriculture.—The development of rural industries must prove to be a boon to agriculture, benefiting both the farmer and the agricultural worker. The latter, during the long winter evenings and also during severe weather, when he is prevented from working on the land, will be able to supplement his earnings by joining a group of village industry workers. This will tend to stem the tide of migration from the villages to the already overpopulated towns and will somewhat mitigate the labour problem of the farmer, while bringing prosperity to the rural districts.

Although the Society has only recently been established, considerable support has already been received from many associations throughout the country. This augurs well for its future success. In this connection it may be mentioned that 54 members of the Home Arts and Industries Association have promised to send all their products to the Society and also to purchase the raw material which they require; and that the Highland Home Industries Association, the Dorset Arts and Crafts Association, and the Wilts Arts and Crafts Association have also promised to dispose of their members' products through the Society. The National Federation of Women's Institutes, to which is affiliated over 2,400 Women's Institutes, propose to take advantage of the trading facilities of the Society.

* * * * * *

THE MIDDLE WHITE PIG.

SANDERS SPENCER.

MANY excuses have been offered for the alleged neglect in the past by the Royal Agricultural Society of the interests of the breeders of Middle White Pigs in not offering prizes for these animals when classes were instituted for Large and for Small Yorkshires, as the Middle Whites were as numerous and as distinct in character as either of the other two Yorkshire breeds. That their commercial value was far superior to that of pigs of the Small White breed has been amply proved, and their

present importance in the pig breeding world is perhaps quite equal to that of the Large White breed. Probably the omission for some years of a separate class for pigs of the Middle White breed was due to the fact that until the formation of the National Pig Breeders' Association some forty-seven years ago, to register the pedigrees of Small, Middle and Large Whites, Small Blacks, and Berkshires, which at that period were the only British breeds of pigs of any importance, there had not been any sufficient attempt made to keep the three first-named breeds distinct. In the minds of far too many people the Middle White pig was one which, mainly from its size, could not be classed as a Small or a Large White. For this error there was sufficient excuse, on account of the far too common system of intermixing the types and then selecting for exhibition in the different classes those pigs which at the time were considered the more nearly to comply with the regulation size and points of the particular breed for which the prizes were offered. The absence of a fair and sufficient representation of breeders of pigs on the Councils of the Royal Agricultural and other Societies has also been alleged to have been the principal cause of the admitted neglect of the pig, whose presence in the show yards was, in the past, looked upon as a necessary nuisance. The want of prescience on the part of those who formerly failed to encourage the exhibition of Middle White pigs has been most clearly proved at one or two of the recent shows of the Royal Agricultural Society, where the exhibits of Middle White pigs ranked with those of Berkshires and Large Whites, whilst two other breeds which in the eighties of the last century were considered to be worthy of separate classes, have both died natural deaths.

The extinction of the Small White and the Small Black breeds and the great improvement in pigs of the Berkshire breed during the past forty years have together proved that the breeders of pigs have given considerably more attention to the commercial points of the pig without seriously affecting its exhibition value. At the same time we are compelled to admit that there still exists room for improvement in the proportion of lean to fat meat, in the prolificacy of the sows and in their ability to rear large and vigorous litters of pigs. We do not mention these weaknesses as having special application to pigs of the Middle White breed, as the pork from them ranks high on the market, whilst the sows are specially noted for their marked ability to produce and to rear large litters of strong and healthy pigs.

These young pigs are also very hardy and good foragers, being particularly well suited for the open-air system of pig feeding, as the writer has proved during more than half a century. The Middle White, like the Berkshire, can be fattened at any age and furnishes pork of fine quality and flavour with a good proportion of lean to fat.

As the demand for small joints of meat is becoming more marked, boars of the Middle White breed are being extensively used for mating with the larger breeds of pigs, which have in far too many instances been bred with a view to the production of pigs of a size not demanded by the purveyor of pork nor by the consumer. Another objection which is made to the very large pigs is the far too great proportion of bone. This trouble is much reduced by the infusion of blood of the Middle White breed. The improvement thus made might probably be increased, rather than reduced, if the breeders of Middle White pigs were to pay rather more attention to the length of the bodies of their pigs and give less consideration to the very short heads and heavy forequarters. Length of carcass is not so much esteemed in the pork pigs as in the pig intended for conversion into bacon, but length of body is nevertheless demanded not only by the pork butcher but is a necessity to the breeding sow which is expected to rear large litters of pigs of a regular size. It has also been remarked that a sow with a long body usually possesses moderately light forequarters, and it may be equally true that thick shoulders and heavy forequarters are seldom associated with heavy milking qualities.

These critical remarks, from which the previous articles have not been free, may be taken as a proof that the perfect pig has not yet been evolved, but it is hoped that they will at least impress upon the breeders of all pedigree pigs the urgent necessity of giving every attention to the utility points of their respective breeds of pigs, and to the requirements of the consumer. The continued success of any breed of pig will depend to a very large extent on its supplying a commercial want.

The standard of excellence of the Middle White pig issued by the National Pig Breeders' Association is as follows :—

Colour.—White, free from black hairs or blue spots on the skin.

Head.—Moderately short, face dished, snout broad and turned up, jowl full, wide between ears.

Ears.—Fairly large, carried erect and fringed with fine hair.

Neck.—Medium length, proportionately full to the shoulders.

Chest.—Wide and deep.

Shoulders.—Level across the top, moderately wide, free from coarseness.

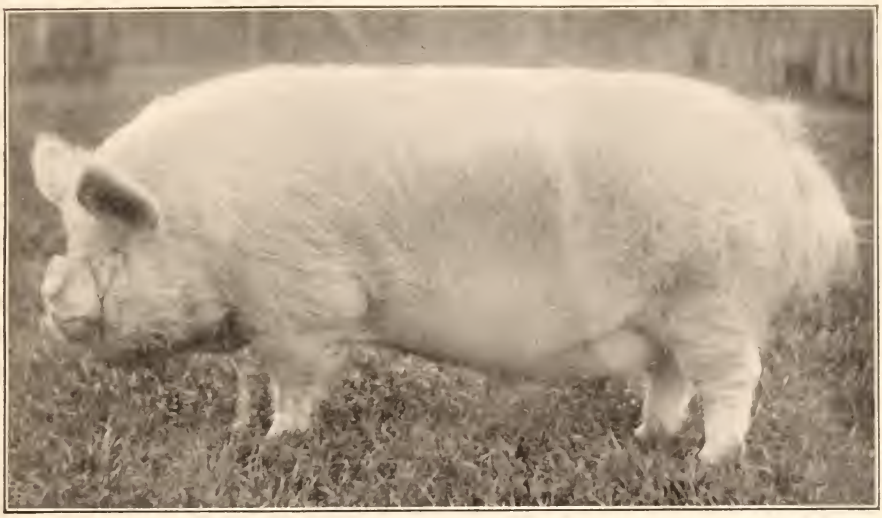

FIG. 1.—Middle White Boar.

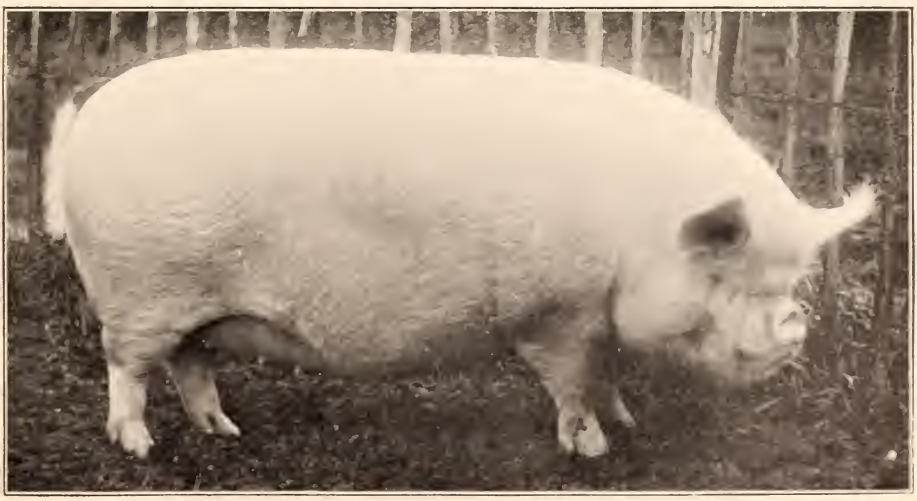

FIG. 2.—Middle White Sow.

Legs.—Straight and well set, level with the outside of the body, with fine bone.
Pasterns.—Short and springy.
Feet.—Strong, even and wide.
Back.—Long, level and wide from neck to rump.
Loin.—Broad.
Tail.—Set high, moderately long but not coarse, with tassel of fine hair.
Sides.—Deep.
Ribs.—Well sprung.
Belly.—Full but not flabby, with straight underline.
Flank.—Thick and well let down.
Quarters.—Long and wide.
Hams.—Broad, full and deep to hocks.
Coat.—Long, fine and silky.
Action.—Firm and free.
Skin.—Fine and quite free from wrinkles.

Objections.—Black hairs, black or blue spots, a coarse mane, inbent knees, hollowness at back of shoulder, wrinkled skin.

* * * * * *

THE RHODODENDRON BUG.

(*Leptobyrsa* (*Stephanitis*) *rhododendri*, Horv.)

THE Rhododendron Bug is not a native of Great Britain and was first observed in this country in 1910, but it had probably been introduced some years earlier. It is now distributed throughout the rhododendron-growing districts of the southern and south-western counties and occurs in East Anglia. Although the country of origin is not definitely known the bug is present in many parts of the United States of America and it seems likely that it is a native of the Eastern States of North America, from which it has been distributed to Europe in the course of the trade in living plants.

The Rhododendron Bug is also known as the Rhododendron Fly and the Lace Fly, but the two last terms should be avoided, (1) because the insect is not a fly, and (2) because the true Lace Wing* is a most useful insect and so not to be confused with such a pest as is here described.

Plants Attacked and Nature of Damage.—The Rhododendron Bug is found upon rhododendrons and in the United States on species of *Kalmia*, the newer rhododendron hybrids being far more susceptible to damage than the long-established *Rhododendron ponticum*. The obvious signs of injury are the presence of chocolate-brown spots on the underside of the leaf and a pale

* See "Beneficial Insects," Ministry of Agriculture, price 4d., post free.

"freckling" on the upper surface (*see* Fig. 1). The bugs themselves live on the undersides of the leaves from which they suck the sap through minute punctures, each wound showing subsequently as a brown spot or scar. A brown gummy secretion is also often present owing to "bleeding" from the puncture holes. In mild cases the effect of the injury is to make the plant "unthrifty," the leaves being obviously unhealthy. In more severe cases the whole plant appears to wilt, and where the attack is combined with unfavourable weather conditions—as, for instance, a prolonged drought—death may occur.

Description and Life-History.—The appearance of the adult bug is shown by Fig. 2. The general colour is greyish-white, while the spaces between the veins on the wings are shining and transparent like glass. The body is black and for the most part hidden by the wings, which form a complete shield over the "back" and are probably not often used for flying. The bugs themselves are full-grown during July and may then be found living on the undersides of the rhododendron leaves. So sluggish are they that the leaves may be picked without causing them to move much or even attempt to fly.

After pairing the female lays her eggs within but at the side of the midrib of the leaf—also, though rarely, within the substance of the leaf itself. Several eggs are usually placed together, more or less in a line, but little can be seen of them, as they are almost wholly embedded in the rib, their position being marked by a scab of gummy secretion. The shape of the egg is shown by Fig. 3 and it will be noticed that only the tip of the egg reaches the surface. If the scab above mentioned be raised this tip can be seen as a minute ring—the "door" through which in due time the young bug will emerge. The bugs die by the end of the summer and the eggs remain through the winter and hatch early the following summer (perhaps late spring).

The young bug, when newly hatched, is a minute, rather spiny, black and grey insect, without wings, and about the size of a pin's head. As has been previously stated, it feeds by piercing the underside of the leaf with its "trunk" (proboscis) and by sucking up the sap. As it grows larger it moults and resembles Fig. 4, and after two further stages in which the developing wings can be seen, it casts its skin for the last time and becomes the fully winged adult bug.

At all stages the bugs are rather sluggish and tend to remain where they were hatched; in consequence the leaves of the previous seasons show the most damage. When the infestation is

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

Rhododendron Bug.

FIG. 1—Infested cutting.
„ 2—Adult Bug.
FIG. 3—Eggs.
„ 4—Young Bug.

considerable and the old leaves are crowded with bugs, the latter seem to spread more readily to the new leaves and then these also show signs of injury. The eggs are laid both on the old leaves and on those of the current season, not exclusively on the latter as has been suggested by some writers.

The spread of the insects from one part of the country to another is almost certainly due to the distribution of infested plants, but in gardens the bugs presumably move from plant to plant even though they seldom seem to use their wings. Too much weight, however, must not be placed on the lack of records of the bugs being seen on the wing, for many usually sluggish insects fly freely under some special weather conditions which perhaps occur on one or two days only during the year.

Methods of Control.—1. *Spraying.*—In U.S.A. rhododendron bugs are killed by spraying them with such an insecticide as soap and water. The chief difficulty consists in wetting thoroughly the undersides of the leaves, which is absolutely essential if success is to be obtained. In the case of small plants and even large bushes, the difficulty can be overcome by the exercise of sufficient care on the part of those spraying, but it is almost insuperable where dense thick shrubberies are concerned unless they are of such value as to justify considerable expense. In spraying rhododendrons it is worth noting that the leaves are easily injured and the work should be done on dull days or in the evening.

A simple soap wash may be made by dissolving 1 lb. of good soft soap in 10 gallons of water. A nicotine wash is more effective and its use is certainly justified in the case of valuable plants or where an attempt is being made to eradicate the pest as opposed to preventing serious injury. It is made by adding 1 fluid oz. of 95-98 per cent. nicotine to each 10 gallons of the above soap wash. If soft water is available the soap may be reduced to $\frac{1}{2}$ lb. to 10 gallons.

2. *Stripping and Hand-Picking.*—As the eggs are laid on the leaves it is clear that if the latter are all removed and burnt during winter the insects should be destroyed. It is not yet known how far this is a practical treatment but it may be mentioned that certain foreign countries appear to be adopting it in the case of rhododendrons for export. Hand-picking in summer is quite effective in the case of a few rhododendrons or at the first appearance of the bug in a previously uninfested garden. The signs of injury are so characteristic and obvious that it is not a difficult matter to remove and destroy infested leaves with the insects upon them.

Administrative Measures.—The Rhododendron bug is included amongst the pests scheduled under the Sale of Diseased Plants Order of 1921, and it is an offence against that Order to sell or offer for sale or cause to be sold or offered for sale any plant which is substantially attacked by Rhododendron Bug. The Order gives power to an Inspector of the Ministry to prevent the sale or movement of such a plant. Moreover, in order to guard against the further importation of this pest, Rhododendrons imported from abroad must be accompanied by a health certificate Diseases of Insects and Pests Order of 1921). The penalty on conviction for an offence against these Orders is a fine not exceeding ten pounds. Further information with regard to the Orders may be obtained on application to the Ministry.

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ANTHRACNOSE OF THE CUCUMBER UNDER GLASS.

II.

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Control of the Disease.—(*a*) *Methods of Sanitation.*—Since it has been shown that *C. oligochaetum* may live from season to season in the rotten woodwork, paper packing, etc., of the houses, it is clear that special methods of winter cleansing must be employed after a season of disease, if the next crop is to be a healthy one.

Fumigation by burning sulphur has not proved efficient in the past and some new method must be sought. Experiments with an emulsion of cresylic acid and soft soap have shown that by thoroughly spraying the diseased woodwork of a house it is possible to destroy the infection. The emulsion is prepared in the following manner:—

> Pale straw-coloured cresylic acid (97-99 per cent. purity) and pure potash soft soap are placed in a bucket at the rate of 1 gallon of the former to 8 pounds of the latter and heated over a brisk fire until the soap is completely dissolved, the process taking about ten minutes to complete. This stock solution may be stored for future use, and the spray fluid is made by using one part of the stock to fifty parts of water.

To be completely efficient the diluted emulsion must be applied from a high-power spraying machine and should be carefully

directed on to every part of the structure, special attention being given to all parts of the woodwork that may be decaying. The ventilators should be left open while the spraying is in progress so that they may be thoroughly treated, but must be closed when the operation is complete, in order to retain the strong vapours. The hands of the operator should be protected by rubber gloves, and goggles worn as the liquid causes the eyes to smart.

The general method of cleansing cucumber houses after a diseased crop should be as follows :—

The plants and soil surface should be submitted to a light spraying with the diluted emulsion to destroy the infection present on the lesions, and then removed for burning. The old beds should next be moved, the houses tidied, and the borders forked, before thoroughly spraying in every nook and cranny with the diluted cresylic emulsion. A fortnight after this treatment the houses may be replanted, but as a final precaution every cavity in the woodwork should be filled with putty and painted over.

(*b*) *Spraying during the Growing Season.*—A great many different kinds of spray solutions have been tested upon this disease, and the most promising results have been obtained with liver of sulphur and lime-sulphur. A wide range of copper mixtures was tested and while the sprayed sections were cleaner than the controls, the fruits were badly spotted in some cases.

One essential quality of first class fruit is the presence of a perfect " bloom " on the surface, and consequently commercial growers hesitate to use any spray which destroys this " bloom " or spots the fruit.

Liver of sulphur and lime-sulphur have not been observed to damage the fruit. The foliage of the cucumber is difficult to wet thoroughly with ordinary aqueous solutions and the addition of an efficient " spreader " is necessary. Soap solution and saponin proved unsatisfactory in this respect, but both flour paste and casein were efficient. Flour paste is cheaper than casein and is therefore to be recommended. Different proportions of flour, liver of sulphur and water have been tested, and it was found that a solution containing 0.5 per cent. of flour and 0.4 per cent. of liver of sulphur was the most satisfactory. If the flour is reduced in amount, the wetting power is less satisfactory, and if the liver of sulphur is increased, a scorching of the young foliage results.

The following formulæ are recommended :—

5 lb. Flour.	1½ oz. Flour.
4 lb. Potassium Sulphide (Liver of sulphur).	1¼ oz. Potassium Sulphide.
100 gallons of water,	2 gallons of water.

To prepare two gallons of spray 1¼ oz. of liver of sulphur are dissolved in 14 pints of water in a bucket, while the flour paste is being made. A very little water (not more than 4 fluid oz.) is added to 1½ oz. of ordinary wheat flour and after the mixture has been rubbed down to smooth paste, 2 pints of water are added. The resulting mixture, which should be as thin as milk and quite as free from lumps, is then boiled, with constant stirring, until it froths up. It is then added to the liver of sulphur solution and mixed thoroughly, when the spray is ready for use.

The following lime-sulphur formulæ have also proved satisfactory :—

5 lb. Flour.	2 oz. Flour.
2 pints Lime-Sulphur (S.G. = 2.3).	1 fluid oz. Lime-Sulphur (S.G. = 1.3).
100 gallons of water.	2½ gallons of water.

Two and a half-gallons of spray are prepared as follows :—Two ounces of flour are mixed and boiled in 3 pints of water in the manner described above, and added to 17 pints of water in a bucket. One fluid ounce of lime-sulphur is then added and the whole thoroughly stirred.

The use of these sprays as a means of checking the spread of the fungus has been tested in commercial nurseries with satisfactory results. To be quite effective they should be used at the early stages of the disease, before the fungus has attacked the succulent leaf-stalk and stem tissues. Generally one or two plants are first attacked, and it is better to sacrifice these than to endanger the rest of the plants by allowing the diseased individuals to remain untreated.

When the disease first appears the plants should be thoroughly sprayed with either of the mixtures recommended, and on the next day every "spotted" leaf should be cut out and burned. This process of spraying and removing the diseased leaves should be repeated again at weekly intervals but generally two applications are enough if the fungus has not entered the petioles or stems. Spraying should be carried out only in the cool of the evening. The next morning the plants should be thoroughly sprayed with water to remove any surplus spray liquid that may have remained on the plants, and a little ventilation should be allowed. Care should be taken to see that the houses are well shaded, as after this treatment direct sunlight may give rise to scorching. The effect of the spray on cucumber plants is slight, if careful attention is given to the above precautions. Occasionally a newly opened leaf or tendril is burned, but rarely is there

any appreciable damage. If the fungus is allowed to get a strong hold upon the leaf-stalk or stem tissues, it is increasingly difficult permanently to check the disease. Its spread may be stopped for a time, but as only the spores and spore-bearing parts of the fungus on the outside of the plant are killed, the fungus within the stem grows out in time and produces masses of spores, which are rapidly carried about the house and the disease again appears. In these cases it is advisable to remove the diseased individuals and replant the house after thoroughly cleaning it.

The cleansing may be effected by means of the cresylic acid emulsion described, after which planting must be deferred for a fortnight; or else by a solution of liver of sulphur at the rate of 6 lb. in 100 gallons of water, or lime-sulphur at the rate of 3 pints per 100 gallons. When liver of sulphur or lime-sulphur is used, the house may be replanted in 24 hours.

(c) *Dusting.*—Dusting with sulphur powders has been extensively tested, but while it checks the rapid spread of the fungus, a complete control has never been observed.

(d) *Cultural Methods.*—Much can be done to prevent and control the disease by providing the best cultural conditions for the plants. The disease assumes its worst form and spreads most rapidly, when the atmosphere of the houses is badly ventilated and saturated with moisture, and also when there is a marked difference between the day and night temperatures in the houses. The conditions which best enable the plants to resist the disease may be summarised as follows :—

Plants should be grown steadily from the beginning, without any attempt at forcing, and a little air should be given whenever outside conditions will allow. The atmosphere of the houses should never be stagnant or saturated with moisture for long periods and efficient circulation of air should be encouraged by suitable ventilation. The beds should never be cold or sour, and careful attention should be paid to the maintenance of constant day and night temperatures.

Conclusions.—(1) *C. oligochaetum*, Cav., which causes Anthracnose of the cucumber, carries on a saprophytic existence in rotten woodwork, timber, paper, etc., in the glasshouses, and thus tides over the winter period.

(2) Straw manure from towns constitutes an important source of infection.

(3) Infected houses may be cleansed by spraying the interior woodwork during the winter with emulsified cresylic acid.

(4) The disease may be controlled during the growing season by employing drastic methods of ventilation, or by alternately spraying the plants with liver of sulphur or lime-sulphur and flour paste, and removing the spotted leaves.

The author wishes to express his thanks to Dr. W. B. Brierley, of Rothamsted Experimental Station, for his kind criticisms and suggestions.

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NOTES ON FEEDING STUFFS FOR SEPTEMBER.

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Potatoes.—The price of potatoes has fallen to such an extent that in many cases the point will have been reached at which it is more economical to feed the potatoes to stock than to sell them in the open market and bring in other feeding stuffs. When rightly used, potatoes are a valuable feeding stuff for live stock. In the majority of cases they may be fed in the raw state without harm, but where facilities for steaming or cooking are available it is better to feed potatoes cooked or steamed. In feeding potatoes, care should be exercised to avoid "greening" since greened potatoes are not only distasteful to stock, but are also poisonous. Frosted or diseased potatoes should always be thoroughly cooked and the cooking water drained away before use.

Potatoes should always be fed mixed with a concentrated food. For pigs, a safe working rule is to allow 6 lb. of potatoes to every lb. of dry meal or concentrate. The potatoes should be thoroughly cooked in the smallest quantity of water that may be necessary, and the requisite amount of meal then added, the resultant mash being fed to the pigs. There is no need to attempt to remove the potato skins before feeding, even in the case of young pigs. Where, however, it is usual to remove the skins before feeding, this is easily effected by rubbing the cooked potatoes through a coarse wire sieve. The mash passes through and the skins are left on the sieve.

Quantities to use.—The practical objections to the use of potatoes for stock may generally be traced to wrong feeding methods. If potatoes are given in too large quantities, digestive disturbances are likely to arise. In feeding potatoes, therefore, the same method should be adopted as is used in the

DESCRIPTION.	Price per Qr. s.	lb.	Price per Ton. £ s.	Manurial Value per Ton. £ s.	Cost of Food Value per Ton. £ s.	Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv. s.	Price per lb. Starch Equiv. d.
Wheat, British	57/6	504	12 16	1 0	11 16	71·6	3/4	1·78
Barley, British Feeding	38/–	400	10 13	0 18	9 15	71	2/9	1·47
,, Canadian No. 4 Western	35/6	400	9 19	0 18	9 1	71	2/7	1·38
Oats, English White	39/–	336	13 0	0 19	12 1	59·5	4/1	2·19
,, ,, Black & Grey	35/–	336	11 13	0 19	10 14	59·5	3/7	1·92
,, Scotch White	39/–	336	13 0	0 19	12 1	59·5	4/1	2·19
,, Chilian	38/6	320	9 19	0 19	9 0	59·5	3/0	1·61
,, Canadian No. 2 Western	32/–	320	11 4	0 19	10 5	59·5	3/5	1·83
,, ,, No. 3 ,,	29/3	320	10 5	0 19	9 6	59·5	3/2	1·70
,, ,, No. 2 Feed	28/6	320	9 19	0 19	9 0	59·5	3/0	1·61
,, American	27/–	320	9 9	0 19	8 10	59·5	2/10	1·52
,, Argentine	27/–	320	9 9	0 19	8 10	59·5	2/10	1·52
Maize, ,,	43/6	480	10 3	0 17	9 6	81	2/4	1·25
,, American	38/–	480	8 17	0 17	8 0	81	2/0	1·07
,, South African	38/9	480	9 1	0 17	8 4	81	2/0	1·07
Beans, Rangoon	8/–	112	8 0	1 15	6 5	67	1/10	0·98
Millers' offals—								
Bran, British	—	—	6 15	1 16	4 19	45	2/2	1·16
Broad Bran	—	—	8 5	1 16	6 9	45	2/10	1·52
Fine middlings (Imported)	—	—	9 10	1 7	8 3	72	2/3	1·20
Coarse middlings	—	—	9 5	1 7	7 18	64	2/6	1·34
Pollards (Imported)	—	—	7 2	1 15	5 7	60	1/9	0·94
Barley Meal	—	—	11 5	0 18	10 7	71	2/11	1·56
Maize ,,	—	—	9 15*	0 17	8 18	81	2/2	1·16
,, ,, S. African	—	—	9 7	0 17	8 10	81	2/1	1·12
,, Germ Meal	—	—	9 12	1 5	8 7	85·3	1/11	1·03
,, Gluten-feed	—	—	9 5	1 11	7 14	75·6	2/0	1·07
Locust Bean Meal	—	—	9 5	0 9	8 16	71·4	2/6	1·34
Bean Meal	—	—	13 10	1 15	11 15	67	3/6	1·87
Fish ,,	—	—	15 0	5 10	9 10	53	3/7	1·92
Linseed Cake, English (9% oil)	—	—	13 2	2 6	10 16	74	2/11	1·56
Cottonseed ,, English (5% oil)	—	—	8 2	2 6	5 16	42	2/9	1·47
,, ,, Egyptian (5% oil)	—	—	8 0	2 6	5 14	42	2/9	1·47
Coconut Cake (6% oil)	—	—	10 15	1 19	8 16	73	2/5	1·29
Palm Kernel Cake (6% oil)	—	—	7 12*	1 9	6 3	75	1/8	0·89
,, ,, ,, Meal (2% oil)	—	—	6 5	1 9	4 16	71·3	1/4	0·71
Feeding Treacle	—	—	4 15	1 1	3 14	51	1/5	0·76
Brewers' grains, dried, ale	—	—	8 5	1 11	6 14	49	2/9	1·47
,, ,, ,, porter	—	—	7 7	1 11	5 16	49	2/4	1·25
,, ,, wet, ale	—	—	1 4	0 8	0 16	15	1/1	0·58
,, ,, wet, porter	—	—	1 0	0 8	0 12	15	–/10	0·45
Malt culms	—	—	8 7	2 3	6 4	43	2/11	1·56

* Prices at Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of July and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton. Its manurial value is £1 9s. per ton. The food value per ton is therefore £8 11s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market.

case of any feeding stuff newly introduced into the ration, *i.e.*, begin with small quantities and gradually increase until the total amount fixed upon is being consumed.

The maximum quantities of potatoes that it is advisable to feed have already been given in previous issues of these notes. They are 17 lb. per head per day for horses, and 28 lb. per head per day for fatting bullocks and cows. Pigs may be given cooked potatoes freely, but raw potatoes, if fed, must be fed cautiously.

Forage Crops for Winter Milk Production.—The increase in milk yield that results when the cows are turned out to grass in the spring is well known to all dairy farmers. In winter milk production, the cows are generally fed on roots, hay and straw chop, and concentrated cakes and meals. Where possible, the addition of a little green food daily will be found to be of value in keeping up the milk yield. For this purpose cabbage and marrow stemmed kale are two suitable crops to grow, and many dairy farmers make a practice of growing them for feeding to the cows during the winter months.

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Fruit Demonstration Plot, Wisbech.

THE Demonstration Fruit Plot which the County Council of the Isle of Ely established near Wisbech in 1920 has been partly planted with fruit trees. Several years must elapse before any definite conclusions can be drawn. The fruit trees which have been planted are mainly worked on the four outstanding types of the Malling stocks and the experiments have been designed to determine the particular stocks which give the best results in the Wisbech district. In addition, most of the newer varieties of dessert apples will be grown, and fruited quickly on very dwarfing stocks. Similarly designed experiments are in progress with pears and plums. Four of the locally popular varieties of apple have been planted to demonstrate methods of orchard arrangement suited to the district, and the trees will be used for pruning tests. There are variety trials of the soft fruits, Gooseberries, Black and Red Currants and Raspberries, in which some of the more recent varieties are included. A large strip of land is now being got ready for planting with Strawberries of several varieties, in the hope of discovering some newer sorts superior in merit to the local favourites:—Sir Joseph Paxton, The Laxton, and Royal Sovereign.

The Wisbech fruit growers have many problems needing investigation, relating to the proper manures for silt soil, and to the control of weevils, capsid bugs and other pests prevalent in the eastern counties, and they should derive much benefit from local experiments carried out on scientific lines.

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Conference on The World's Dairy Congress, 1923.

In connection with the proposal emanating from the Dairy Industry in America to hold a World's Dairy Congress at Philadelphia in October, 1923, a Conference of representatives of the various branches of the Dairy Industry in this country was held on 28th July at the Ministry of Agriculture under the Chairmanship of Sir Francis Floud, K.C.B., Permanent Secretary.

The Conference was addressed by Professor H. E. Van Norman, President of the Congress, who placed before it the details of the proposal, emphasising the views of the promoters of the Congress that milk was an essential food for man and could, with great improvement in the health of most countries' population, be consumed in much greater quantity than at present. He pointed out that the Congress was intended to provide an international exchange for the most recent scientific knowledge and practice in regard to the dairy industry, to afford an opportunity for discussing the various systems of regulation and State control of the Industry, and to consider the influence of dairy products on national health and their vital importance to the development of the people. He stressed the need for increased co-operation amongst producers in improving the conditions of the industry, and generally discussed the benefits which were expected to flow from the holding of the Congress.

There were present representatives of the Royal Agricultural Society, the National Farmers' Union, the British Dairy Farmers' Association, the Agricultural Organisation Society, the Central Chamber of Agriculture, Milk Producers' Associations, Milk Distributors' Associations, the Milk Publicity Council and also representatives of some of the Overseas Dominions and of the various Government Departments interested. Manufacturers of milk products and dairy machinery and apparatus, breed and milk-recording societies, educational and scientific societies, and other bodies interested were also represented.

At the conclusion of the meeting, the following resolution was passed :—

> "That this meeting, having heard Professor Van Norman's statement of the objects, etc., of the World's Dairy Congress to be held in the United States of America in October, 1923, is of opinion that this country should be adequately represented at the Congress, and it requests the Ministry of Agriculture, in conjunction with the Ministry of Health, to invite the various associations and bodies interested in the Milk Industry to nominate representatives to serve on a General Committee to organise the representation of the Industry in England and Wales at the Congress."

A Committee on the lines indicated in this Resolution is now being formed.

* * * * * *

Shrinkage of Potatoes in Clamps.

DURING the last three years the Ministry has arranged for trials with potatoes to be carried out in several districts with the object of ascertaining the amount of shrinkage that takes place in the clamp, and the possibility of preventing the spread of disease in the clamps by treating in the following manner :—(1) spraying during growth, (2) sprinkling with quicklime when clamped, (3) sprinkling with sulphur when clamped.

It appeared in the earlier trials that the sulphur treatment checked the spread of disease in the clamps, but in 1921 no disease appeared in the haulm or tubers on any of the plots and no diseased tubers were found when the clamps were opened, so that verification of this could not be obtained.

As regards shrinkage, the average weight of potatoes put in each clamp on 16th September, 1921, was 2 cwt. 78 lb. On the opening of the clamps on 17th March, 1922, the average weight was 2 cwt. 28 lb., a shrinkage of 50 lb. or 16 per cent.

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Cow Insurance Clubs.

ONE of the best examples of a successful co-operative Cow Insurance Club for small farmers and small holders is at Moulton Chapel, near Spalding. The Moulton Chapel Cow Insurance Club has been run continuously for 38 years entirely by small cow-keepers living within a radius of a few miles of Moulton Chapel. The 24 simple "Rules and Regulations"

which have stood the test of experience were evidently drawn up by men of this class. There are no honorary subscribers.

The number of cows insured at the present time is 330. During last year the subscriptions received from members totalled £205 16s. 0d.; the amount paid for losses was £108, and the credit balance on the year's working amounted to £93 1s. 3d. The reserve fund is not allowed to accumulate to an undue extent; it now stands at £200 on mortgage and £153 at the bank. Last year was a good year for the society; on the other hand the previous year resulted in a loss on the year of £159 13s. 11d., the cow mortality being much above the average.

Owing to the increase in the value of cows, the cost of insuring a cow for one year has been increased from 6s. to 12s. Seventy-five per cent. only of the certified value of the cow is paid to the member; this is a sound rule as it tends to keep out undesirable animals, and negligence when a cow is ill is not encouraged. The important official of a society of this kind is the marker, who should be a good judge of cattle. In establishing a new society, payment of subscriptions in advance helps greatly until funds have been accumulated to withstand the drain of an abnormal season.

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Protection of Purchasers of Poultry Foods Under the Existing Law.

Many complaints have been received by the Ministry as to the adulteration and misdescription of articles sold as food for poultry, and it has often appeared that poultry keepers are unaware of the steps which they can take under the existing law to protect themselves. The principal Act of Parliament bearing on the subject is the Fertilisers and Feeding Stuffs Act, 1906.

Section 1 (2) of this Act provides "that every person who sells for use as food for cattle or poultry any article which has been artificially prepared shall give to the purchaser an invoice stating the name of the article, and whether it has been prepared from one substance or seed or from more than one substance or seed, and in the case of any article artificially prepared otherwise than by being mixed, broken, ground, or chopped, what are the respective percentages (if any) of oil and albuminoids contained in the article, and the invoice shall have effect as a warranty by the seller as to the facts so stated, except that as respects percentages the invoice shall have effect

as a warranty only that the actual percentages do not differ from those stated in the invoice beyond the prescribed limits of error." It also provides that "any statement by the seller of the percentages of the chemical and other ingredients contained in any article sold for use as a fertiliser of the soil, or of the nutritive and other ingredients contained in any article sold for use as a food for cattle or poultry, made after the commencement of this Act in an invoice of such article, or in any circular or advertisement descriptive of such article, shall have effect as a warranty by the seller."

The seller is liable to be prosecuted for any of the following offences:—

(*a*) Failure without reasonable excuse to give on, or before, or as soon as possible after the delivery of the article, the invoice required by this Act, or

(*b*) Causing or permitting any invoice or description of the article sold by him to be false in any material particular to the prejudice of the purchaser; or

(*c*) Selling for use as food for cattle or poultry any article which contains any ingredient deleterious to cattle or poultry, or to which has been added any ingredient worthless for feeding purposes and not disclosed at the time of the sale.

Under this Act also, every County Council is required to appoint an Agricultural Analyst and one or more Official Samplers, The Councils of County Boroughs are empowered to make the same appointments, and many of them have done so. Such appointments are subject to approval by the Ministry.

In nearly every case, arrangements have been made for samples of poultry food to be analysed by the Agricultural Analyst at very low fees, and the advice and assistance of an Official Sampler can generally be obtained free of charge. Poultry-keepers should ascertain from the Clerk to the Council of the County or County Borough what arrangements are in operation in the district in which he is carrying on business.

The purchaser, therefore, of poultry food can in a great measure protect himself by requiring from the seller of the material he is purchasing, a definite description of the material and then submitting the article to the Agricultural Analyst for analysis. Care should be taken to ensure that any sample submitted is representative of the bulk, otherwise the results of the analysis may be misleading.

If the services of an Official Sampler can be secured, and the sample is taken in the prescribed manner by him, all question

as to whether the sample is representative of the bulk will be, as far as possible, avoided.

In cases where the seller refuses to give an invoice as required by the Act, the purchaser should communicate with the Official Sampler, who will generally deal with the matter under the Act.

The real significance of many of the terms used to describe poultry foods is very doubtful and buyers should endeavour to obtain a full description of the article, and should not be contented with the name only.

* * * * * *

The Purchase of Compound Manures.

Many farmers are in the habit of purchasing compound or complete manures. This procedure certainly saves the trouble of mixing artificial manures on the farm. On the other hand different crops and different fields have different manurial requirements, and in each case a mixture of manurial ingredients in different proportions is likely to be required. Examples of mixtures suitable for different crops in various cases and hints on the mixing of manures are given in the Ministry's Leaflet No. 344.

No farmer should order a compound manure until he has obtained from the vendor and carefully studied an analysis of the manure in question. The agricultural value of a manure depends on the amount of plant food—nitrogen, phosphates and potash—which it contains, and on the form in which these three foods are offered to the crop.

Suppose a farmer is offered a ton of manure containing, say, 5 per cent. (or 1 cwt.) of nitrogen, 15 per cent. (or 3 cwt.) of soluble phosphates, 5 per cent. (or 1 cwt.) of insoluble phosphates, and $2\frac{1}{2}$ per cent. (or $\frac{1}{2}$ cwt.) of potash. What should he pay for it? Certainly little more than the sum at which he can purchase, and, if required, mix, artificials of recognised agricultural value containing the same amount of fertilising material. Now 20 cwt. of sulphate of ammonia contain roughly about 4 cwt. of nitrogen—therefore to get 1 cwt. of nitrogen, he must buy 5 cwt. sulphate of ammonia, costing to-day about £4. Again, 20 cwt. of superphosphate contain roughly about 7 cwt. of soluble phosphate—therefore to get 3 cwt. of soluble phosphate he will need to buy about 9 cwt. of superphosphate, costing to-day about £2 5s. Next, 20 cwt. of steamed bone flour contain roughly about 12 cwt. of insoluble phosphates—he will need, therefore, about $1\frac{2}{3}$ cwt. of this, costing, say, 13s. 4d. Finally, 20 cwt.

of kainit contain about 2½ cwt. of potash—he will need, therefore, 4 cwt. of kainit costing about 12s. Thus he can obtain standard manures of equal agricultural value to that offered for £7 10s. 4d. Put in another way the equivalents are: for every 1 per cent. of nitrogen offered, 1 cwt. of sulphate of ammonia; for every 1 per cent. soluble phosphates, ⅔ cwt. of superphosphate; for every 1 per cent. of insoluble phosphate, ⅓ cwt. of steamed bone flour; and for every 1 per cent. of potash, 1⅗ cwt. of kainit.

The above is a rough method only. A more accurate method is to find the unit values (*i.e.*, the value of 1 per cent. per ton, or 22.4 lb.) of nitrogen, soluble phosphates, insoluble phosphates and potash in standard manures (*e.g.*, sulphate of ammonia, superphosphate, steamed bone flour and kainit as above) multiply by the percentages of each in the compound manure and add the results, adding an allowance for cost of mixing. Taking as above, sulphate of ammonia (20 per cent. nitrogen) at £16 per ton, superphosphate (32 per cent. soluble phosphates) at £4 10s. per ton, steamed bone flour (60 per cent. total phosphates) at £8 per ton, and kainit (12½ per cent. potash) at £3 per ton, then the unit values are: nitrogen 16s.; soluble phosphate 2s. 10d.; insoluble phosphate 2s. 8d.; and potash 4s. 10d. A ton of a compound manure containing 5 per cent. of nitrogen, 15 per cent. of soluble phosphates, 5 per cent. of insoluble phosphates, and 2½ per cent. of potash, would be worth, therefore, 5 × 16s. *plus* 15 × 2s. 10d. *plus* 5 × 2s. 8d. *plus* 2½ × 4s. 10d. = £7 7s. 11d. per ton *plus* an allowance as explained above for mixing.

In working out unit prices in this way care must be taken to observe whether the prices on which calculations are based are prices delivered at the farm or nearest railway station, or prices at the works: if the latter, carriage of course must be added. The quantities (*e.g.*, 2 ton lots) to which the prices relate should also be noted, relatively more per unit will have to be paid for small than for large quantities.

The unit method of valuation also allows of the prices of standard manures being compared with one another. A full account of the method will be found in the Ministry's Leaflets Nos. 72 and 80. Unit values at London are regularly published in the Ministry's *Agricultural Market Report* (price 2d.) each week.

* * * * * *

Warmley and District Allotments: Village Co-operation in Gloucestershire.

A useful example of the value of co-operation for small cultivators and poultry keepers is afforded by the Society known as The Warmley and District Allotments, Ltd. The Society was established in November, 1919, its original objects being to help members to obtain land for allotments, to arrange for lectures, and to obtain expert advice on gardening. The allotments have been obtained through the Parish Council and the lectures and advice have been given by the County Organiser and his staff.

The Society joined the Bristol and District Small Holdings and Allotments Federation, Ltd., and also became affiliated to the Agricultural Organisation Society. The Federation advised as to land suitable for allotments and in the first year provided seed potatoes through its system of collective purchase.

The Society started with 19 members and there are now 183. The subscription is one shilling per annum. Trading is done on a basis of 5 per cent. profit, and was started by buying seed potatoes with the object of securing reliable Scotch seed, true to type and at the lowest rates. The Bristol Federation booked the Society's order in November, 1919, which was fortunate, as in the spring of 1920 supplies were unobtainable and the first year's dealings with seed potatoes proved very successful, but the second year, however, the Society received a severe set-back: it purchased on its own account seed potatoes from Scotland in October when prices were high, the general belief being that, as in the previous year, supplies would not be obtainable later. There was a heavy drop in prices before delivery, and two tons of the seed potatoes proved to be diseased. There was a loss of £50 on this purchase, which was a very severe blow to this small Society.

After the first year's successful trading in potatoes, the poultry keepers urged the Society to supply them with food. In April, therefore, a start was made by buying meals and grains direct from the mills, and it was found that the members could be supplied at a saving of 10 per cent. on the prices then obtaining locally, though the local prices quickly dropped in sympathy. This brought in many new adherents to the Society, and the supply of foodstuffs is now the biggest part of its trade. The total turnover last year was £824 11s. 9d.

Courses of lectures are arranged to cover the winter months, and the County Instructors visit the members' gardens, allot-

ments, and poultry yards, during the spring and summer to give advice. During the first summer of its existence, the Society organised a small horticultural show.

* * * * * *

Agricultural Returns, England and Wales, 1922.

The preliminary tabulation of the Agricultural Returns collected on the 3rd June, 1922, in respect of agricultural holdings above one acre in England and Wales shows that the area under all crops and grass is 26,024,000 acres, or 120,000 acres less than last year. There is, however, an increase of 56,000 acres in the area returned as rough grazings, so that the reduction in the total acreage of land covered by these returns is about 64,000 acres. The cultivated area comprises 11,309,000 acres of arable land and 14,715,000 acres of permanent grass.

PRELIMINARY STATEMENT of Acreage under CROPS and GRASS in England and Wales on 3rd June, 1922.

DISTRIBUTION.	1922.	1921.	INCREASE.		DECREASE.	
	Acres.	*Acres.*	*Acres.*	*Per Cent.*	*Acres.*	*Per Cent.*
TOTAL ACREAGE under all CROPS and GRASS	26,024,000	26,144,000	—	—	120,000	0·5
*ROUGH GRAZINGS	4,762,000	4,706,000	56,000	1·2	—	—
ARABLE LAND	11,309,000	11,618,000	—	—	309,000	2·7
PERMANENT GRASS — For Hay	4,412,000	4,053,000	359,000	8·9	—	—
PERMANENT GRASS — Not for Hay	10,303,000	10,473,000	—	—	170,000	1·6
PERMANENT GRASS — TOTAL	14,715,000	14,526,000	189,000	1·3	—	—
Wheat — Autumn Sown	1,933,000	1,911,000	22,000	1·2	—	—
Wheat — Spring Sown	36,000	65,000	—	—	29,000	44·6
Wheat — TOTAL	1,969,000	1,976,000	—	—	7,000	0·4
Barley	1,362,000	1,436,000	—	—	74,000	5·2
Oats	2,161,000	2,149,000	12,000	0·6	—	—
Mixed Corn	126,500	135,500	—	—	9,000	6·6
Rye	85,500	78,800	6,700	8·5	—	—
Beans	285,000	246,800	38,200	15·5	—	—
Peas	173,400	142,600	30,800	21·6	—	—
Potatoes	561,100	557,800	3,300	0·6	—	—
Turnips and Swedes	820,400	895,000	—	—	74,600	8·4
Mangold	422,600	374,800	47,800	12·8	—	—
Cabbage, Savoys and Kale	73,500	58,000	15,500	26·7	—	—
Kohl-rabi	16,400	9,900	6,500	65·7	—	—
Rape	74,900	82,000	—	—	7,100	8·7
Vetches or Tares	135,900	103,700	32,200	31·1	—	—
Lucerne	50,500	47,200	3,300	7·0	—	—
Mustard	39,500	45,200	—	—	5,700	12·6
Brussels Sprouts	15,100	12,500	2,600	20·8	—	—
Cauliflower or Broccoli	10,600	8,600	2,000	23·3	—	—
Carrots	14,100	8,200	5,900	72·0	—	—
Onions	3,600	2,900	700	24·1	—	—
Sugar Beet	8,400	8,300	100	1·2	—	—
Flax for Fibre	4,700	1,700	3,000	176·5	—	—
Linseed	4,800	6,100	—	—	1,300	21·3
Hops	26,300	25,100	1,200	4·8	—	—
Small Fruit	75,000	72,600	2,400	3·3	—	—
CLOVER and ROTATION GRASSES — For Hay	1,526,000	1,758,000	—	—	232,000	13·2
CLOVER and ROTATION GRASSES — Not for Hay	776,000	791,000	—	—	15,000	1·9
CLOVER and ROTATION GRASSES — TOTAL	2,302,000	2,549,000	—	—	247,000	9·7
BARE FALLOW	404,600	506,700	—	—	102,100	20·1

* Mountain, Heath, Moor, Down and other rough land used for grazing.

The arable area has been reduced by 309,000 acres, but it is still 311,000 acres greater than in 1914. In spite of this reduction the area under most crops is larger than last year, the decline in the total being more than accounted for by reductions in the area of clover and rotation grasses and bare fallow. As regards live stock the head of cattle has been increased, but the number both of sheep and pigs is less.

Cereals.—The area of wheat, 1,969,000 acres, is practically the same as in 1921, and some 233,000 acres greater than the pre-war average. Barley is being grown on an appreciably smaller area than last year, only 1,362,000 acres being under this crop against 1,436,000 acres in 1921. The acreage of oats is 2,161,000 acres, or 12,000 acres more than last year, and 98,000 acres more than the average of the ten years before the war. The total area under the three chief cereal crops (including mixed corn) is 5,618,000 acres, or 78,000 acres less than in 1921.

Beans and Peas.—The area of both beans and peas has been increased very appreciably, the former being grown on 285,000 acres against 246,800 acres last year, and the latter covering 173,400 acres, an increase of 30,800 acres.

Potatoes.—The very large area devoted to potatoes in 1921 has been fully maintained, 561,000 acres being under this crop. There is an increase in Lincoln and the north, the area being reduced in most other counties.

Roots.—The area returned as under turnips and swedes is 820,000 acres, or 74,600 acres less than last year, which was the lowest previously recorded. Since the date of the returns, however, a good deal of turnip sowing has been done on land which may have been returned as fallow in some cases. The mangold area has been largely increased, 422,600 acres being under this crop, against only 374,800 acres in 1921. The acreage of mangolds is the largest since 1914.

Other Crops.—Practically all other crops have been increased in area, only rape, mustard and linseed showing decreases. Among fodder crops, kohl-rabi and vetches in particular show large increases. All the vegetable crops have been much increased, the addition being very large in the case of carrots. Hops and small fruit have each been planted on additional areas, though in neither case is the rise nearly so great as in 1921. The large increase recorded last year in sugar beet has been maintained.

Clover and Rotation Grasses.—Owing to the failure of so many sowings last year, the area of clover and rotation grasses has been reduced by 247,000 acres to 2,302,000 acres. The reduction was much the heavier in the eastern half of the country, where the drought of last season was felt the more severely. The area reserved for hay is some 232,000 acres less than in 1921, but this is counterbalanced by an increase of 359,000 acres in the area of permanent grass for mowing.

Horses.—The number of horses on agricultural holdings has been reduced by 44,300 to 1,340,300. A further decline in breeding is to be noted, the number of foals being only 83,800 or 8,500 less than last year and 18,300 less than in 1914.

Cattle.—The total number of cattle, 5,721,800, is 205,000 greater than last year. Cows and heifers in milk or in calf number 2,521,400 or 20,000 more than in 1921, and the largest on record except in 1918 and 1919. The number of heifers in calf is, however, 74,300 less than the high figure of last year, but

is still some 17,000 greater than in 1920. The large increase in the number of calves recorded last year has practically been maintained, whilst the number of yearling cattle is 30 per cent. greater than in 1921. The heavy slaughtering of calves in the spring of 1920 shows this year in cattle two years old and above which number 78,300 less than last year.

PRELIMINARY STATEMENT of Numbers of LIVE STOCK in England and Wales on 3rd June, 1922.

	No.	*No.*	*No.*	*Per Cent.*	*No.*	*Per Cent.*
Horses used for Agricultural purposes (including Mares for Breeding)	804,700	822,700	—	—	18,000	2·2
Unbroken Horses (including Stallions) One year and above	231,200	232,700	—	—	1,500	0·6
Unbroken Horses (including Stallions) Under one year ..	83,800	92,300	—	—	8,500	9·3
Other Horses	220,600	236,900	—	—	16,300	6·9
TOTAL OF HORSES	1,340,300	1,384,600	—	—	44,300	3·2
Cows and Heifers in Milk	1,933,600	1,876,100	57,500	3·1	—	—
Cows in Calf, but not in Milk	288,600	251,800	36,800	14·6	—	—
Heifers in Calf	299,200	373,500	—	—	74,300	19·9
Other Cattle :—Two years and above ..	923,200	1,001,500	—	—	78,300	7·8
,, ,, One year and under two	1,166,600	893,500	273,100	30·6	—	—
,, ,, Under one year.. ..	1,110,600	1,120,300	—	—	9,700	0·9
TOTAL OF CATTLE	5,721,800	5,516,700	205,100	3·7	—	—
Ewes kept for Breeding..	5,424,400	5,336,500	87,900	1·6	—	—
Other Sheep :—One year and above ..	2,296,900	2,850,900	—	—	554,000	19·4
,, ,, Under one year	5,715,400	5,644,100	71,300	1·3	—	—
TOTAL OF SHEEP	13,436,700	13,831,500	—	—	394,800	2·9
Sows kept for Breeding	301,700	335,900	—	—	34,200	10·2
Other Pigs..	1,995,000	2,169,600	—	—	174,600	8·0
TOTAL OF PIGS	2,296,000	2,505,500	—	—	208,800	8·3

Sheep.—The shortage of keep last winter, which caused an early marketing of feeding sheep, coupled with the very high prices which have ruled for fat sheep during past months has resulted in a reduction in the number of sheep since last year, the total being 13,437,000 or 395,000 less than a year ago. The reduction is, however, confined to sheep other than ewes and lambs, the breeding flock having been again increased, though not to the same extent as last year.

Pigs.—The large increase in the number of pigs last year has not been maintained. The total, 2,296,700, is some 208,800 less than in 1921, but still over 300,000 more than in 1920, and, apart from last year, is the largest since 1915.

* * * * * *

Foot-and-Mouth Disease.—No outbreaks of foot-and-mouth disease have occurred since 30th June last, and all general restrictions on account of that disease have now been withdrawn. The dates on which the various districts under restriction on 30th June were freed, were *Derbyshire (Chesterfield)* area, 3rd July; *Northumberland* area, 22nd July; *Lancashire* and *Cheshire* areas, 23rd July; *Derbyshire (Bakewell)* area, 25th July; *West Lancashire (Poulten)* area, 25th July; *Birmingham* area, 25th July; *Berwickshire (Coldingham)* area, 1st August.

Berwickshire area was the last district subject to restriction imposed by the Foot-and-Mouth Disease (Great Britain) Orders. The maintenance of restrictions for such a prolonged period was necessary owing to the adoption of isolation in respect of certain outbreaks in that district.

ACREAGE OF HOPS.—Preliminary Statement compiled from the Returns collected on the 3rd June, 1922, showing the ACREAGE under **Hops** in each COUNTY of ENGLAND in which Hops were grown, with a COMPARATIVE STATEMENT for the years 1921 and 1920.

COUNTIES, &c.		1922.	1921.	1920.
		Acres.	*Acres.*	*Acres.*
KENT	East	4,010	4,010	3,260
	Mid	5,520	5,410	4,520
	Weald ...	7,110	6,630	5,710
	Total, Kent ...	16,640	16,050	13,490
HANTS		1,070	1,040	840
HEREFORD		3,950	3,520	2,990
SURREY		220	200	170
SUSSEX		2,330	2,270	1,790
WORCESTER		2,030	1,960	1,660
OTHER COUNTIES		90	90	60
TOTAL		26,330	25,130	21,000

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NOTICES OF BOOKS.

Agricultural Co-operation in England and Wales.—(W. H. Warman, with a Preface by Leslie Scott, K.C., M.P. London: Williams and Norgate. Price 5s. net.) It is a strange fact that persons who regard themselves as being practical and hard-headed and independent of theories are nearly always theory-ridden. The only difference is that the theories are theirs, of long and cherished establishment, and neither new nor derived from other people. There is an idea that the English farmer, even the most progressive of the class, is afraid or impatient of theories. Hence when Sir Leslie Scott wrote the Preface to this book, he was careful to insist that the practice of agricultural co-operation does not involve the acceptance of a social theory. Yet the practice of co-operation, in any industry, involves a theory of commerce; and the buying, selling and transport of goods constitutes a high proportion of a nation's economic activities. It is a striking commentary on the present economic organization, that the transport and distribution of goods require anything from a quarter to one-half the amount of labour that is required to produce them. This is the case even with farm produce. Indeed, in some individual cases, such as bread, there may be more labour used in the transport, manufacture and distribution of the finished article than in the production of the raw material. This is the reason why the form and condition of the organization for buying and selling farm produce is of such great importance to the farmer. The present organization for buying and selling is based on one theory, the co-operative organization is based on another, and even if these theories are unimportant to the English farmer, the result of the practices may mean the difference between profit and loss on the farm.

The value of theories, however, often depends upon the way in which they are established. The best are nearly always those which arise direct from the

consideration of the relevant facts, and if the theory arises from the facts without conscious search for it, its influence is greater than that of one for which there has been a conscious and logical process of seeking. This is the method pursued by Mr. Warman in his book. His intention was "to explain the aims and the ideas which animate co-operators as well as the facts of the present position," but he allows the aims and the ideas to emerge from the facts. For those who are afraid of theories, this book need hold no terrors. It is a plain unvarnished story, yet it has all the elements of sound material and thorough workmanship which should appeal to farmers if they are as practical minded as their friends think and declare them to be.

It is impossible to summarise the contents of a book so fitted with facts as this, for here are garnered as many facts as could be conveniently stored within the covers of any one book on the subject. If it contains little theory it also contains little history, for the story of the early agricultural co-operative movement in England is contained in about 18 pages. The greater part of the book is devoted to the recording of events and movements since 1913 and to the discussion of current problems. This means that it summarises the experiences of the movement within the memory of those who are now concerned in its welfare. It goes farther than this, however, for where problems have arisen for which no solution has appeared in this country, some of the experience and methods of other countries is given. Yet this book differs from all others on agricultural co-operation in its primarily English character and its insistence upon the importance of English experience.

Naturally the discussion of the problem of the Agricultural Wholesale Society receives a good deal of attention, and as it is difficult to deal adequately with the pros and cons of this subject, those interested should read with care Chapter V. The chapter on the Agricultural Organization Society seems scarcely adequate, but it was good policy to give the available space to the description and discussion of the work of the actual trading societies. The most interesting matter in the book is in Appendix A, which should not be overlooked by any reader. This summarises the experience of twenty years' work in a very brief and illuminating way. Here the main general principles which must govern every successful co-operative movement are laid bare, and again it should be clear that they have arisen directly from experience.

"As a mere business method" co-operation "has justified itself." Still "the avenues for co-operative developments are unlimited," only "each step forward has to be considered on its merits." As long as English agricultural co-operators look at their experience and aims in this way there is every prospect of the continued success of their movement. They need not be afraid of theories when they derive them from experience, even though the co-operative movements of other countries have developed theories and practices which would not be acceptable to English farmers of the present day. This is a thoroughly English book which should be read by all who are interested in agricultural trading, including even the many critics of the co-operative movement.

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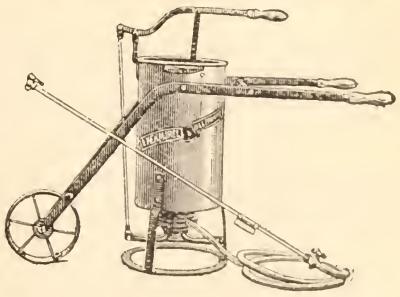

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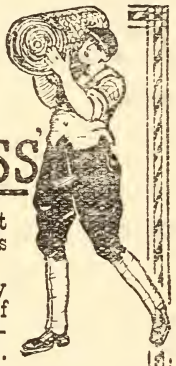

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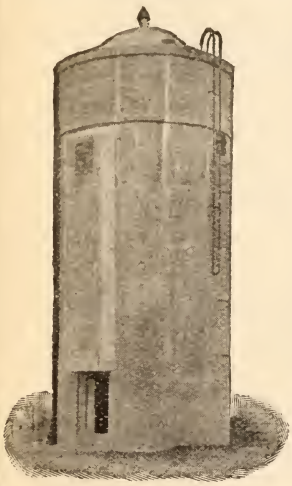

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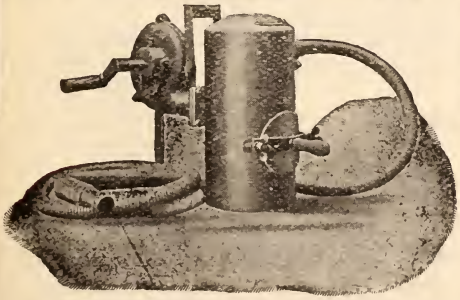

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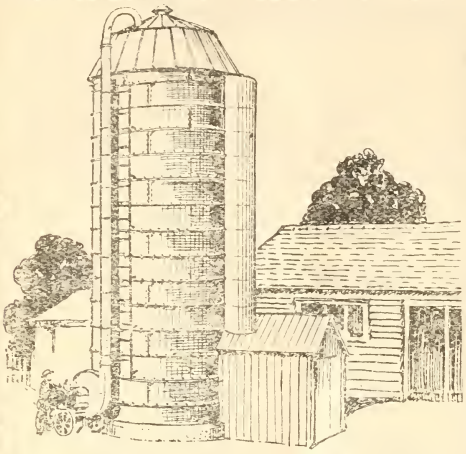

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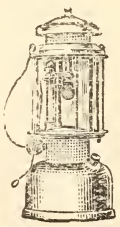

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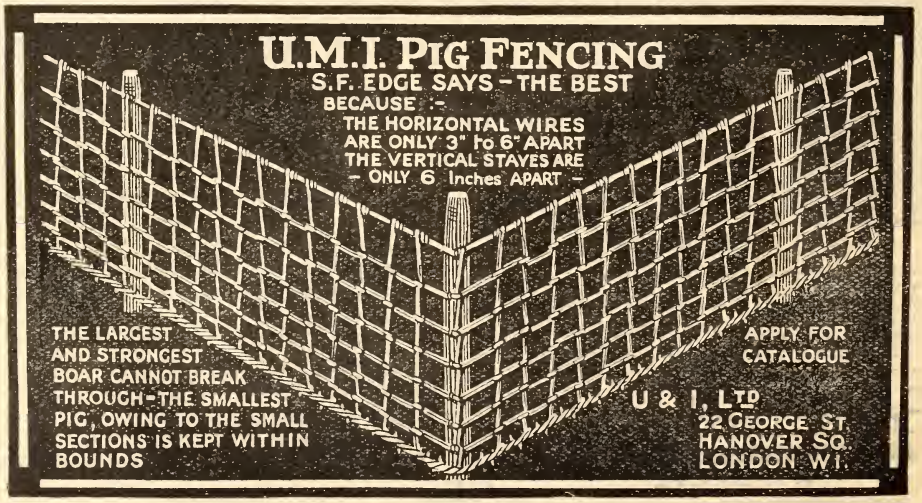

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